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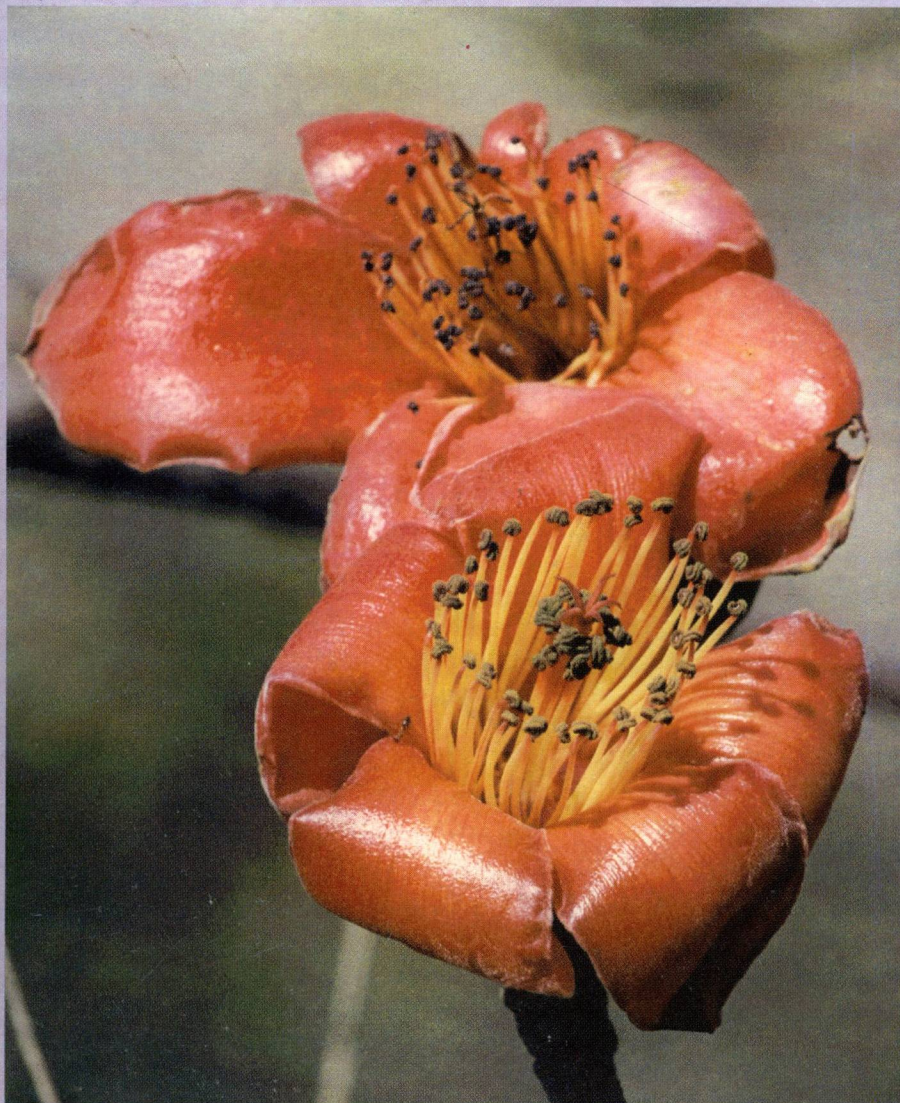
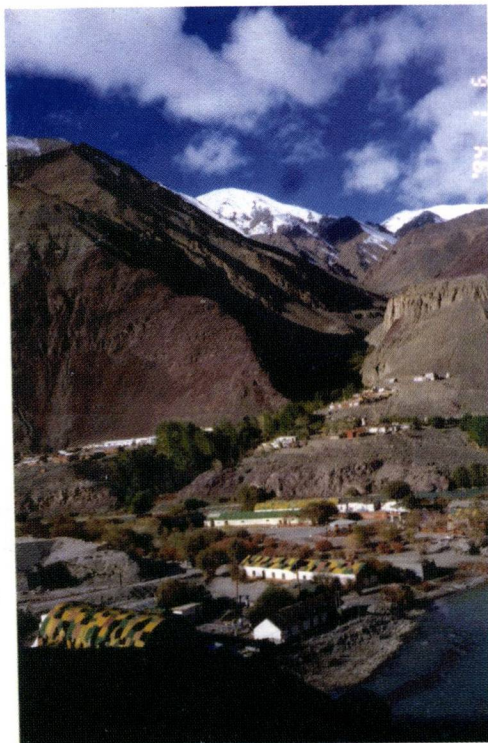


Photo by Bhgat Singh

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Our Armed Forces try to comfirt themselves even at these desolate place (Ladakh)
Photo - A.S. Negi



Approaching a Forest Rest House in Uttarkashi, Uttarakhand
Photo - A.S. Negi

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Cover Page

Flower of *Salamalia malabaricum* (Semal or Indian Cotton Tree)

Large deciduous tree common in Dehradun, Saharanpur ascending to 4000' altitude in the outer Himalayas and in valleys in hills.

Stem straight more or less buttressed at the base when old.

Flowers 4-5 inches across, fleshy. Calyx very fleshy, cup shaped bright silky hairy inside, petals crimson or orange, 3-6 inches long. Flowering - Jan - Mar, Fruit - April - May, cupshape 5-7 inches long seeds obovate, smooth, surrounded by long white silky hairs.

Wood is very soft and perishable but durable under water.

The Sariska Fiasco & After

***A.S. Negi IFS(Retd.)**

The Sariska fiasco is a great cause of concern for all the conservation conscious people all over the world. It is not because a first ever noble project launched in the field of conservation, with initial success has suffered a setback but because a big question mark has sprung up about the capability of the age old department of Forests who has been entrusted with the custody of most important of the treasures on the earth, that is forests and their inhabitants.

I have served the Forest Department for a long stint of 38 years including some exclusive periods of service in wildlife sector. During all my service, I never had any doubt on the capability and sincerity of our frontline staff provided they were lead and guided properly. It is their commitment all through that we still have some good forests and wildlife with such a vast sea of underprivileged and poor population surrounding them. Then what went wrong and where? Why their sincerity could not be sustained and enhanced. It is because they were neglected not only by our overall system but also by their own masters. The debate could be very long and yet non conclusive and unacceptable to most of the people who matter. I would not like to dwell on fault findings and criticism of the service or degenerating political system, rather on something which can still be corrected.

Ministry of Environment & forests, Govt. of India constituted Expert Committee to evaluate and monitor the Tiger Reserves of the country and I was one of the members of the Committee who had a chance to monitor 11 Tiger Reserves of the country out of 27 at that time. On the basis of experience gained during monitoring of these TRs and also on the basis of my personal experience in managing Corbett, the foremost TR of the country for a period of 5 years, I want to highlight some points:

1. Are we bothered about the Tiger Reserves under Project Tiger or about the Tiger itself? I think our approach should be holistic. Even after taking large chunks of Forest land, where tiger presence was sizable, under the Project Tiger (PT) we still had about 50% of the tiger population outside PT areas to begin with. It is an established fact that the population of wild animals has a direct relationship with vastness of undisturbed wilderness areas. It is more relevant to large mammals such as tigers, elephants, rhinos, bison etc. In the case of tigers, who are territorial in habit, a smaller area, howsoever protected and disturbance free it may be, its carrying capacity would be limited for tigers even when their prey-base is optimum in number.

In most of the PT areas, there is either absence of buffer, as it was in case of Sariska, or the buffer has too much of biotic interference and degradation and it is not being managed by the Field Directors of respective PT areas. The State Govts. have been very miser in handing over the management of buffer areas to the wildlife managers. There is a sharp difference of opinion among the Forest Officers themselves and the officers in charge of Territorial Divisions do not want to part with the territory traditionally held by them under their charge. The wildlife managers, though they come from the same service, are objects of great envy by their counterparts in the service. In many

States, in-charge of wildlife wing has been upgraded to the highest rank in the department but that too has not solved the problem.

At this time of tiger crisis a national strategy should be made to save the tiger along with whom many other lesser mortals of flora and fauna will also get protection.

All the areas bearing tiger population should be mapped and a Landscape Management Plan should be made for the clusters, which are in contiguity, treating PT areas as core of each cluster. The focus of management in these clusters should be tiger and all other practices should be strictly modified to favor the tiger and its habitat. If the cluster happens to be larger, then a Chief Conservator of Forests can be put incharge of the cluster who can coordinate the landscape plan with the management plan of the PT area and the Working Plans of adjoining Forest Divisions. As far as possible wildlife trained officers should be put incharge of the Forest Divisions falling in these clusters. Where such clusters are absent and the PT area is isolated, a different approach for these areas can be taken.

Where such clusters in spite of sizable tiger population have absence of Tiger Project, a suitable area should be included in the PT to improve and focus the management of tigers.

An effort to identify high priority areas and actions for the conservation of tigers in the wild has been made by WWF-US and Wildlife Conservation Society on the global tiger range level and published in 1997. This effort is again on the landscape level, stressing the need that any conservation effort for the tiger has to be on a landscape level and can not be based on a strategy of isolated Tiger Project areas.

The landscape approach also ensures the long term conservation strategy through planned developmental activities in that area ensuring that the vital corridors and connectivities are not disturbed. Even the overall development activities in the cluster can be coordinated with the eco development needs of that area.

2. Once the clusters have been formed, the Govt. of India would have to review its funding strategy under the PT and instead of funding individual PT areas, the clusters can be taken as funding units. This will also help the State Govts. to gear up their machinery, though the level of budget requirement could be on a much higher level. Without desired financial support from Govt. of India tiger conservation cannot be improved.

3. Tiger is not tolerant to disturbance to its habitat and its breeding and consequently the population is adversely affected by biotic influences. It is therefore necessary to make all the core areas of PTs free from human disturbances. This is possible only by relocating the villages inside core areas. Though such areas have been identified for relocation outside TRs long back but the action at field level is very slow and detrimental to tiger population. During my visit to 11 Tiger Project areas in MP, Chhattisgarh, Orissa, Andhra and Maharashtra, it was observed that the relocation of villages from core of PT areas was facing uphill task. One major reason was non lucrative relocation package. Not only the relocation package needs to be revised by Govt. of India but one strong committee needs to be formed at the Govt. of India level to monitor this programme in all the States.

Relocation is a sensitive issue with socio economic ramifications, so the people will have to be given due weightage and the Committee should also include members from concerned sectors of Govt. and NGOs. There should be a time bound programme for relocation. The NPV (Net Present Value) being charged on State Govts for land transfer cases by the Govt. of India will have to be waived off as this is for the betterment of the environment and is one of the major causes for delay in relocation.

4. Eco-development programme in villages having influence over the PT areas is an important programme which is ultimately going to matter because without people's support tiger conservation like any other programme is not going to succeed. Ecodevelopment should not be taken as pumping extra money in the area and increasing the purchasing power and changing the lifestyle of the people from sustainable to unsustainable. The entire development of the area should be such that dependence on forest resources decreases and awareness among people about conservation in general goes up. Also the vital corridors and connectivities are not disturbed. The funds being made available at the moment, by Tiger Conservation Authority (TCA) are very meager and their utilization in isolation is not having any perceptible impact. In a cluster/landscape approach it will be easier to coordinate all the developmental activities in these areas under the District/Commissionary level Committee to be chaired by the Collector/Commissioner. The nodal officer would have to be the Field Director of the concerning PT.

5. Poaching and illegal trade of tiger parts is another major cause for decrease of tiger population. A National/International level network of trade already exists. The non conventional methods of poaching are generally being adopted and certain tribes/groups are engaged in tiger poaching all over the tiger range. The Forest Departments approach towards illegal trade and poaching is totally regional in nature. Other law enforcement agencies are either ignorant about the modus operandi of poacher/traders or they are too busy with other more familiar forms of crimes that they have to deal. The gangs responsible for wildlife crimes are therefore in a better position as the law enforcement against them is concerned.

The creation of a 'Wildlife Crime Bureau' has already taken place at the Govt. of India level which needs to be strengthened further with Forest Officers of repute and experience at the helm of affairs. The State Govts should also set up some machinery in their police force with Forest Officers taken on deputation.

Some particular tribes are deeply involved in all wildlife poaching and trade. These should be identified and steps to rehabilitate them in alternative jobs/activities could be taken as a part of eco-development programme. Their modus operandi needs to be studied and strict measure to counter them at all levels taken.

6. Training is an important tool to improve the management. The country has Wildlife Institute of India responsible for training programmes for officers (Diploma and Certificate Courses). So far only 756 officers (FRO & above) have been trained in these courses. Taking the total strength of forest officers, the number of trained officers is hardly about 10%. Not only the intake should be increased but some policy would have to be formulated at the Govt. of India level for sponsorship of officers for such courses and utilization of such officers after training by the State Governments.

Forestry being a concurrent subject and the training being funded by Govt. of India, there should be no difficulty in doing so.

Training of frontline staff in wildlife has been neglected by almost all the states except M.P. There are some training institutes specifically for wildlife training in some States and there are training centers in all States for training of Forest Guards and Foresters. Wildlife Institute could be asked to prepare a structured course for frontline staff of not less than 5 months duration for wildlife management. The training at State training centers could be supervised and coordinated by WII and the central funding could be made by Govt. of India for this purpose. This would be very important to keep up the efficiency and morale of frontline staff and to expose them to various Management practices being followed in different areas.

7. Census of tigers and other wild animals has always been a subject of controversy and the State Forest Departments have been following techniques of wildlife estimation differently though the general principle and guidelines may have been common. The estimation of tiger and their prey species should be done under the supervision of Committee of experts to be appointed by Govt. of India for each state comprising of experts, scientist, NGOs, media person, Hon'y. Wildlife Wardens and public representatives etc. All the field staff should be placed under the committee for this purpose during census/wildlife estimation period on the lines of human census making Chief Wildlife Wardens of the States as the coordinators.

Wildlife estimation in MP and Orissa particularly in the Project Tiger areas had been streamlined and the level of accuracy was reasonably good. The credit goes to Sri H.S. Panwar and Late Padamshree Sri S.R. Chowdhary who worked hard to make the pugmark census, user friendly and reliable. In Simlipal TR of Orissa they had the practice of demarcating the territories of Male tigers on ground with display boards as under:

**You are in the territory of
Male Tiger
M-24
(There are two females in
his territory one with 2 cubs)**

This shows the seriousness of analysis of estimation exercise done in those days which appears very convincing. This exercise was also witnessed during census operation in Tadoba-Andheri TR visited by me as member of Expert Committee for monitoring and evaluation of TRs, where one Forest Ranger was trying to critically examine the territories of Male Tigers in his Forest Range. The presence of Research Officers of good repute in Kanha and Simlipal TRs for long periods has also been the factor for critical analysis of the annual estimation exercise, which was also followed up by the frontline staff during their routine patrolling. The collection of plaster casts and tracings of pugmarks found during patrolling and using them at the time of annual estimation exercise for

authentication of results is also being followed in M.P and few other States. These good practices should be followed in all the TRs and even outside TRs for more reliable estimates.

Giving the exact numbers is also misleading. Only range of minimum and maximum estimates should be given instead of exact numbers (example 75 to 85 or 80 to 100 etc).

The pugmark method of census was evolved at a time when the tiger numbers were thought to be reasonably on safeside. This method was used in tiger reserves which started in early seventies & most of the tigers were then outside tiger reserves. The number of TRs increased subsequently & number of tigers outside these reserves declined very fast due to deforestation of habitats & lack of proper management strategy. After Sariska fiasco a task force was created by the Prime Minister on the recommendation of which certain immediate remedial measures were taken. Creation of Tiger Conservation Authority & all India census of tigers by Ministry of Environment & Forests Govt of India with technical guidance of Wildlife Institute of India in collaboration with Tiger states were positive fall outs of their recommendations.

The all India tiger estimation process consisting of various scientific approaches such as

Double Sampling

Use of logistic regression

Occupancy modeling

Were used for finding of the refined all India Tiger estimation. This revealed the total country level population of tigers as 1411 (mid value) the lower & upper values being 1165 and 1657 respectively. The assessment is based on determining spatial occupancy of tigers throughout potential tiger forests and sampling such forest using camera traps on a statistical framework. This assessment however is said to be not comparable to the earlier total count using pugmarks owing to several shortcomings in the latter. The new findings indicate a poor status of tiger population in areas outside tiger reserves and protected areas. It is believed that the tiger population by and large, in tiger reserves and protected areas of such States are viable, while requiring on going conservation efforts.

8. Patrolling of Forests by frontline staff has been the backbone of protection mechanism. On foot patrolling alone can generate information from the field and it also acts as a deterrent against poachers provided that the patrolling party is strong enough and is well equipped and trained. Effectiveness of patrolling depends on the degree of supervision, planning and participation by officers. It has been felt that the patrolling is no more effective due to lack of supervision, planning and self participation by officers. The tradition of the department used to be like Army where even the highest officers used to visit interior areas frequently with their subordinates. The culture of patrolling the forests has to be revived at all levels by giving some incentives and devising ways and means to strengthen and sustain this age old good practice in the interest of conservation of not only the tiger but all other forms of flora and fauna. Regular refresher training courses could also help to revive this great tradition.

9. Sariska tiger reserve in Rajasthan, which suffered a total annihilation of tiger population inspite of being managed as a Tiger Reserve for over 3 decades has now got one male & 2 female tigers relocated from Ranthambor TR as a bold step in the direction of conservation efforts. Several initiatives have been taken by the state Govt to ensure safety & security of relocated tigers & it is hoped that Sariska once again gains its lost glory and the relocation experiment can be used as an example in other areas where we have lost the tiger due to one reason or the other.

You can bend it and twist it You can misuse and abuse it but even God cannot change the truth

Michael Levy

Balance peace, and joy are the fruits of a successful life. It starts with recognising your talents and finding ways to serve others by using them

Thomas Kinkade

ROLE OF FARM FORESTRY AND AGRO-FORESTRY IN CARBON SEQUESTRATION-SOME CASE STUDIES FROM INDIA

***Dr. Mohit Gera, IFS**

ABSTRACT

The paper highlights the role of Afforestation and Reforestation CDM projects under Farm & Agroforestry. The project requirements, CDM project cycle, important issues involved in agroforestry CDM projects and enabling conditions for such projects have been discussed. The paper also describe briefly the case studies carried out for estimation of carbon sequestration potential, cost effectiveness of such projects and likely benefits to the farmers for growing trees on the farm lands. Despite increasing market demand for the CERs, the demand for the CERs generated out of A&R CDM projects appear to be limited for the first commitment period.

INTRODUCTION

Expression of public concern over climate change issues began with first World Climate Conference held in 1979. This led to the establishment of an intergovernmental panel on climate change (IPCC) in 1988, which issued its first assessment report in 1990 and confirmed that threat to climate change was real. This gave rise to adoption of United Nations Framework Convention on Climate Change (UNFCCC) on 9th May, 1992, which later opened for signature at the Earth Summit. The Convention came into force on 21st March, 1994 and with 194 countries as parties to the convention till date, it has now become the most universally adopted Convention (Anon., 2003)

After about three years of hectic negotiations, a substantial extension to the Convention that outlined legally binding commitments was adopted at the third meeting of conference of parties (COP3), known as *Kyoto Protocol* (KP), held in December, 1997. As per KP industrialized countries were assigned legally binding emission reduction targets that amount to an aggregate reduction shared among all such countries of at least 5.2% from 1990 levels by the year 2008-12, known as first commitment period. The individual emissions reduction targets for each country are listed in Annex B to the protocol. The KP was to enter into force, provided it was ratified by at least 55 parties to the convention, including enough industrialized countries to encompass 55% of that group's CO₂ emissions of 1990 level. These conditions ensured that no single party to the convention may block the entry into force of KP. The protocol has since been ratified and came into force on 16th Feb, 2005.

The Kyoto Protocol also provided three innovative mechanisms designed to boost the cost-effectiveness of climate change mitigation by opening ways for the parties to cut emissions, or

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enhance carbon sinks, more cheaply abroad than at home. These mechanisms are joint implementation (JI), emission trading (ET) and clean development mechanism (CDM). Out of the three mechanisms, only CDM is relevant to developing countries like India. The aim of CDM is that the industrialized countries would invest in 'clean' projects in developing countries and emission reduced or removals increased through such investments would be credited to them. CDM is expected to generate investment in developing countries, especially from private sector to contribute towards objectives of UNFCCC, enhance the transfer of environmentally friendly technologies and promote sustainable development in general.

Forestry sector is one of the important sources of CO₂ emissions which accounts for 1.6± 0.8 Gtc annually. This constitutes 20% of the global CO₂ emissions (Ravindra Nath & Murthy, 2003). Deforestation, forest degradation, fragmentation and diversion of forest land for not forest purposes are the main sources of CO₂ emissions and also the key issues in developing countries. At the same time, the forestry sector also offers large CO₂ mitigation opportunities for removal of accumulated CO₂ in atmosphere, and sequester it in vegetation, soil and wood products (Sharma et.al, 2003). The removal of CO₂ from atmosphere can be achieved at comparatively lower costs in the forestry sector when compared with other sectors such as energy, chemical industry, transport, agriculture and waste disposal. Moreover, the costs are likely to be lower when sequestration activities take place in developing countries like India.

CDM forestry projects are limited to afforestation and reforestation (A & R). The carbon pools accepted under these projects are above ground biomass (AGM), below ground biomass (BGB), woody litter and the soil carbon. There is another important carbon pool which comes into play when a tree is harvested and wood products are made of it that have varying life spans. Carbon continues to be locked in such wood products during their life spans and benefits should accrue because of locked carbon. This carbon pool is known as harvested wood products (HWP) which is being a contentious issue, is under negotiation and benefits on account of this pool are not eligible for first commitment period.

The land area that could potentially be brought under A & R projects in India, particularly under non-forest and wastelands categories could be large and may vary between 66-130 million ha. The types of A & R activities likely to be eligible under CDM include Agro/Farm forestry, raising of mixed species plantations, assisted natural regeneration of areas with potential root stock and orchards etc. (Ravindranath and Murthy, 2003).

Under CDM the emission offsets or removals are measured in tons of CO₂ equivalent and are known as certified emission reductions (CERs). The CERs generated from CDM projects can be used by investing industrialized nations to meet their own emission reduction targets. The CERs can be of three types viz., normal CERs, long term CERs (iCERs) and temporary CERs (tCERs). Due to possibility of reversibility of additional C-pools generated out of A & R projects, the certified emission reductions generated from forestry projects can be limited to iCERs or tCERs. Agro forestry refers to land use systems and practices where woody perennials are deliberately integrated with crops and/or animals on the same land management unit (ICRAF). Apparently man

has been practicing agroforestry since he learnt the art of cultivating agricultural crops and domestication of livestock. One of the earliest example of growing crops with tree species is shifting cultivation in India, which is partly prehistoric, and partly a response to agro-ecological conditions in the NE region (Tejwani, 1994). According to some experts a strictly scientific definition of agroforestry should stress two characteristics, viz., deliberate raising of woody perennials on the same unit of land with agricultural crops and there must be significant interaction between the woody and other components of the practice.

Tree based land use systems such as natural forest, forest plantations, farm forestry and agro forestry sequester CO₂ through the carbon stored in their biomass, soil and the wood products. Agroforestry, owing to its huge potential and quick carbon locking capability on a short as well a long-term basis, offers tremendous opportunities to the large number of farmers in the country. Agroforestry is also the key source of industrial wood as such raw material is not available from government forests. This coupled with non-availability of land for captive plantations give rise to huge demand for wood products from the farmlands.

To meet the growing demand of industrial wood, large-scale plantations of fast growing species have been raised on the farmlands of the country. Poplar and Eucalyptus are such species widely planted in India in the states of Jammu & Kashmir, Punjab, Haryana, Uttar Pradesh, Andhra Pradesh, Tamilnadu, Uttarakhand and North Bengal. Poplar however is confined only to northern parts of the country. These species are widely accepted by farmers in agroforestry because of minimum interference with agricultural crops due to their crown and root architecture and favourable silvicultural characters. Farmers have planted them in blocks, bunds and lines along with wheat, paddy, sugarcane, maize, mustard, pulse and few other crops.

REQUIREMENTS FOR A&R CDM PROJECTS

i) Definition of forest, afforestation and reforestation

Under the CDM, forestry projects come under LULUCF, i.e, land use, land use change and forestry. The terms like forest, afforestation and reforestation are defined in the CDM text as: *"Forest is a minimum area of land of 0.05-1.0 ha with tree crown cover (or equivalent stocking level) of more than 10-30% with trees with the potential to reach a minimum height of 2-5 meters at maturity in-situ."*

Each developing country was supposed to submit its own definition giving a value for minimum area, tree crown cover and minimum tree height within the provided definition. India has already submitted its definition which is a minimum area of 0.05 ha, crown cover of more than 30% and minimum height of 5 meters. Therefore the definition of forest accepted by India is *"Forest is a minimum area of land of 0.05 ha with tree crown cover (or equivalent stocking level) of more than 30% with trees with the potential to reach a minimum height of 5 meters at maturity in-situ"*.

This definition accepted and communicated by India requires that any land devoid of adequate tree cover, say agriculture, wasteland or forests will have to be either afforested or reforested on a minimum area of 500sq.m with such trees which have a potential to reach a minimum height of 5 m

at maturity and so densely planted that the crown cover reaches from less than 30% before planting to more than 30% during the CDM project activity.

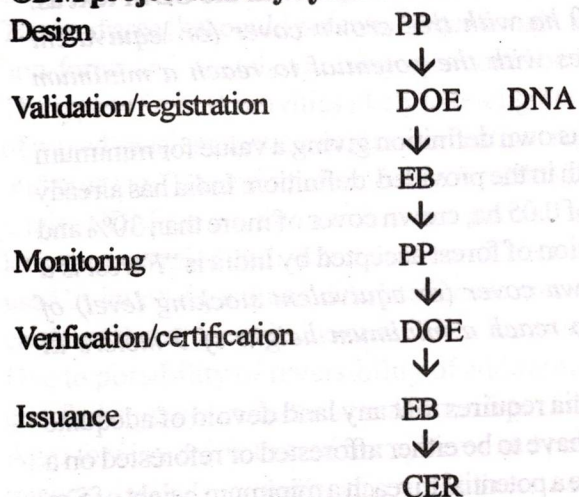
This definition has adversely affected the prospects of agroforestry projects on the grounds that majority of farmers prefer bund plantations and most of such plantations are unable to achieve the required tree crown cover of 30% to qualify as a CDM project activity. Plantation of Poplar, which has a larger crown, on bunds of a small piece of land say 500 sq.m may qualify this requirement of 30% but it will be difficult with other species or if the piece of land is bigger (Dhiman, 2006). The requirement of minimum tree height also has adverse affects such as plantation of horticulture species like Kinoo, Guava and most favoured species for bio-diesel, i.e., Jatropha which are not able to reach 5 m on maturity will also not be eligible under the CDM A & R projects.

Afforestation is defined as *the direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human-induced promotion of natural seed sources. This is relevant to agriculture areas wastelands and other fallow lands which can be taken up for CDM A & R projects.* Reforestation is *'the direct human-induced conversion of non-forested land through planting, seeding and / or the human-induced conversion of non-forested land'*. For the first commitment period, reforestation activities will be limited to reforestation occurring on those lands that were not classified as forests as per CDM definition as on 31.12.1989.

ii) CDM project activity cycle

Participants to the CDM project activity must prepare a project design document (PDD), including a description of the baseline and monitoring methodology to be used, an analysis of environmental impacts, comments received from local stakeholders and a description of new and additional environmental benefits that the project is intended to generate. An independent operational entity, also called designated operational entity (DOE), will then review this document and, after providing an opportunity for public comments, decide whether or not to validate it.

CDM project activity cycle



When a project is duly validated, the operational entity will forward it to the Executive Board of CDM for formal registration. Unless a participating Party or three Executive Board members request a review of the project, its registration becomes final after eight weeks. Once a project is running, it will be monitored by the project participants. They will prepare a monitoring report, including an estimate of CERs generated by the project, and will submit it for verification by the DOE. To avoid conflict of interest, this will usually be a different DOE to that which validated the projects. Following a detailed review of the project, which may include an onsite inspection, the DOE will produce a verification report and, if all is well, will then certify the emission reductions as real. Unless a participating Party or three Executive Board members request a review within 15 days, the Board will issue the CERs and distribute them to project participants as requested. Finally, CERs generated by CDM projects will be subject to a levy known as the 'share of the proceeds'. Two percent of the CERs from each project will be paid into the "*Adaptation Fund*" to help particularly vulnerable developing countries to adapt to the adverse effects of climate change. Projects in least developed countries are exempted from paying this share of the proceeds. Another percentage, yet to be determined, will be levied on projects to cover the CDM's administrative costs. In the meantime Parties to the convention have been urged to help finance these expenses by making voluntary contributions to a UNFCCC Trust Fund for Supplementary Activities (UNFCCC, 2003)

iii) Important issues in CDM project development

There are a number of issues which must be addressed, while formulating an agroforestry CDM project and the important among these are Additionality, Baseline, Leakage and Performance. **Additionality** – this requires that C-stocks accrued to a C-Sequestration project are "additional" to those that would occur in the absence of the project. One may argue that the agroforestry systems are a well recognized "business as usual" practice and cannot be treated as additional. However enabling conditions for a successful agroforestry project may not exist in most of the areas and a project that facilitates such conditions can qualify as a CDM project. Tools for demonstration and assessment of additionality in A & R CDM projects are available. As per these tools, the proposed A & R project activity should have alternatives, it should not be financially most attractive and if so, proper barrier analysis will have to be carried out to prove that the project activity is additional.

Development of baseline- The baseline is the scenario that reasonably represent the anthropogenic emissions by sources of GHGs that would occur in absence of proposed project activity. A clear and verifiable baseline scenario giving C- stock changes in 'without project' situation needs to be presented using approved methodologies. To date there are a few project specific methods for determining the base lines but there remains a need to develop a set of standard methods for agro/ farm forestry that are not only reasonably accurate but are flexible enough to accommodate various project conditions at the regional and national levels.

Leakage- Leakage is the increase in GHG emissions by sources which occur outside the boundary of the project activity but are measurable and attributable to the project activity. The project should also demonstrate how leakage issues will be addressed to ensure sustained carbon benefits.

Since the project areas dedicated to agroforestry plantations are generally not yielding woody biomass prior to their use as agriculture areas, the possibility of leakage is very low to nil.

Permanence – This is concerned with the durability of C-stocks in agroforestry CDM projects. Permanence is a serious issue due to a possibility of reversibility in C-stocks due to anthropogenic or environmental changes. The issue of permanence is addressed for LULUCF project activities by accounting for emission reductions as temporary CER (tCER) or long term CER (iCER). A tCER expires at the end of the commitment period following the one during which it was issued, while a iCER expires at the end of the crediting period for which it was issued (UNFCCC, 2004). Both tCERs and the iCERs are likely to command lower prices compared to the permanent CERs because after the expiry such CERs, the buyer will have to arrange for the replacement accordingly.

Project activities A & R– The project activities, which are also called interventions need to be described clearly. For example, in case of farm forestry one needs to give the models of tree plantations on farmlands. These should be well defined models, may be four-five in number, for which biomass calculations on per hectare basis can be undertaken on periodic basis. Too many agroforestry/farm forestry models with different plantation designs may make the calculations very complex, and should be avoided.

CASE STUDIES ON A & R PROJECTS

The studies being reported in this article were carried out in the project on “Methodological issues in forestry mitigation projects” jointly by Indian Council of Forestry Research & Education and Indian Institute of Sciences. United States Environmental Protection Agency (USEPA) provided the funding and the other collaborating institute was Lawrence Berkley Laboratory, Berkley, US.

The studies were carried out on parts of Bazpur block of Udham Singh Nagar District and Betalghat block of Nainital District of Uttarakhand (Hooda et al., 2007). In Bazpur, an area of 6200 ha consisted of 35 villages with the main land used as agriculture, was selected for the study. Due to declaring of that area as export promotion zone (EPZ), more and more land is being dedicated to raising of orchards of Litchi and Mango. Five villages were selected as per stratified random sampling, to represent the studied site in order to collect data on land use, socio-economic characteristics, tree plantation activities on farm lands, plantation trends, area availability for future plantations under A & R, choice of species, fuelwood, fodder and small timber needs. Data was collected at village as well as household level, using structured questionnaires (Hooda et al. 2007).

For estimation of carbon flows, the authors considered five C-pools viz., above ground biomass (AGB), below ground biomass (BGB), woody litter, soil carbon and harvested wood products (HWP). Since only first four carbon pools were eligible under CDM benefits for first commitment period, calculations were carried out for “Without Wood Product” scenario.

Five sample plots each of 0.1 ha area was selected in all the plantation models for collecting data on above ground biomass, woody litter and soil carbon. Above ground biomass was worked out by using relevant equations/factors and below ground biomass was calculated as $AGB \times 0.26$. sequestered carbon was calculated in the model by multiplying the dry biomass with a default value of 0.45. For estimation of soil organic carbon, three representative soil samples were drawn from each selected plantation and the neighbouring areas where no such plantations existed. Soil from

within a depth of 30cm was dug up and representative sample was drawn. For analyses of soil carbon the samples were passed through 100 mesh round hole sieve and Walkley and Blake rapid titration method (Walkley, 1947) was adopted. For estimation of woody litter, all fresh twigs, branches and other woody parts of the trees fallen within a year were collected from a unit area (1m^2) from these randomly selected sites. After going through the plantation models as being practiced in the study area and conducting rapid rural appraisal, following five plantation models were finalized:

- i) Poplar block planting (5x4 m spacing)
- ii) Eucalyptus bund planting (2 m spacing)
- iii) Teak block planting (2x2 m followed by two thinning and final harvest)
- iv) Mango orchard planting (10 x 10m spacing)
- v) Litchi orchard planting (10 x 10 m spacing)

Based on the plantation trends and willingness of the people for future plantations, authors estimated that under the five interventions the area planted as A&R project activity would be 1190 ha, 590 ha, 177 ha, 355ha and 355 ha for Poplar, Eucalyptus, Teak, Mango and Litchi respectively. The spreadsheet model PRO-COMAP, acronym "project based comprehensive mitigation assessment process" (Sathaye *et al.*, 1995) was employed for the analyses of the input data. The model is designed specifically to undertake a comprehensive assessment the role of forestry sector in climate change mitigation efforts. The end-use scenario based approach was followed, which takes into consideration the end-users need for forest products and land. It assumed that the extent of afforestation activities under agro forestry to be embarked upon would be driven essentially by the need of wood products and economic returns associated over the period of analyses.

Annual incremental carbon sequestered under different interventions and likely carbon benefits is presented in Table 1. Maximum incremental potential per ha of 2.85tC was calculated for Teak block plantation followed by 2.13 and 1.64 tC, 1.46tC and 1.46tC for Poplar, Eucalyptus, Mango and Litchi plantations respectively. The weighted average of 1.89tC per ha of sequestration was reported for the whole project site.

Table 1: Annual incremental carbon, carbon benefits and total carbon sequestered under mitigation scenario (without wood products).

Plantation Model	Land area(ha)	Annual incremental C (tC)	Annual incremental C per ha(tC)	Likely benefits (Rs ha ⁻¹ yr ⁻¹)
Poplar	1190	2530	2.13	1251/-
Eucalyptus	590	970	1.64	963/-
Teak	177	505	2.85	1674/-
Mango	355	520	1.46	857/-
Litchi	355	520	1.46	857/-
Total	2,667	1515.40	1.89	

*Weighted average value@ Carbon price \$4/TCO₂ and 1\$ =Rs. 40/-

Based on the study report the author has done the revised calculations as per carbon price of \$4 per ton of carbon dioxide for a ICER. The annual incremental carbon per hectare calculated under different plantation models is likely to give benefits of Rs. 1251/-, Rs. 963/-, Rs 1674/-, Rs 857/- and Rs 857/- for Poplar, Eucalyptus, Teak, Mango and Litchi plantations respectively on per hectare per year basis.

The key factor governing the cost effectiveness of these interventions is however the price of wood products on harvest. For example, Poplar and Eucalyptus have faced glut in the markets in the past when the prices came down heavily. Poplar wood prices, which were around Rs. 450-500/- per quintal for round wood above 24" girth in 1998-99, came down to a low of Rs. 130/- per quintal in Sept 2003 when this study was carried out, mainly due to over production and other factors associated to it. The price however has recovered to around Rs. 400/- per quintal now a days and likely benefits of planting Poplar block plantation are much higher than reported.

For the similar study on tree plantation with Khair, Chir pine, mixed plantations, Mango and Kinoo in selected villages of Betalghat block of Nainital district, annual incremental carbon sequestered under different interventions and likely carbon benefits is presented in Table 2. Maximum incremental potential per ha of 7.1 tC has been reported for Chirpine plantation followed by 5.9 tC, 1.7 tC and 1.5 tC and 0.2 tC for mixed plantation, Mango, Khair and Kinoo plantations respectively. The weighted average of 4.1 tC per ha was estimated for the whole project site.

Table 2: Average annual incremental carbon & total carbon sequestered under tree plantation (without wood products)

Plantation Model	Land Area (ha)	Average Annual Incremental C(tc)	Annual incremental C per ha (tC)	Likely benefits (Rs. ha ⁻¹ yr)	Total Cstored
Khair	248	372	1.5	881/-	11165
Chir pine	543	3868	7.1	4169/-	116044
Mixed	300	1790	5.9	3464/-	53713
Mango	300	513	1.7	998/-	15381
Kinoo	198	31	0.2	117/-	939
Total	1589	1819*	4.1*		197242

*Weighted average figures@ Carbon price of \$4/tCO₂ and 1\$ = Rs. 40/- (Source: Table 1&2 are from phase -I report of the project "Methodological issues in forestry mitigation- a case study from Bajpur & Betalghat by Hooda et.al., 2005)

The annual increment carbon per hectare calculated as per the present carbon price of \$4 per ton of CO₂ under different plantation models is likely to give benefits of Rs. 4169/-, Rs. 3464/-, Rs. 998/-, Rs. 881/- and Rs. 117/- for Chirpine, Mixed plantation, Mango, Khair and Kinoo plantations respectively on per hectare per year basis.

The third study was carried out by Centre for sustainable technologies & Centre for Ecological Sciences, Indian Institute of Science in Guaribidanur block of Kolar district of Karnataka. Out of total area of 40,000 ha crop area at the study site the communities were willing to dedicate 5% for block planting and 10% area for bund plantation under farm forestry option. The choice of the species along with C-sequestration potential estimates are given in Table 3.

Table 3: The sequestration potential under different project activities.

Land Category Proposed	Project Activities	Species to be Planted	Area to be Planted(ha)	Sequestration potential during the project period(2005-35) tC/ha
Farmland	Short rotation	Eucalyptus spp.	228	11.65
Block planting	Long rotation	<i>Tectona grandis</i> <i>Grevillea robusta</i>	128	28.06
	Fruit orchard	<i>Acharas sapota</i>	1065	47.42
Farmland bund planting	Long roation +fruit orchard	<i>Tectona grandis</i> <i>Grevillea robusta</i>	3960	3.81

Source : Phase – I report of the project “Methodological issues in forestry mitigation – a case study of Kolar district by Ravindranath, et.al. 2005)

The choice of species indicatd by the farmers for planting as a block or bund indicates that there is a preference for recurring as well as sustained economic benefits in the long run.

Table 4: Average annual incremental carbon & coal carbon sequestered under tree plantation (without wood products)

Project Activity	Land area (ha)	Annual incremental C per ha (tC)	Likely benefits (Rs. ha ⁻¹ yr)	TotalC stored
Short rot	228	0.38	86/-	2,656
Long rot	128	0.94	212/-	3,592
Fruit Orchard	1065	1.58	356/-	50,502
Long rot + Fruit orchard	3960	0.13	29/-	15,088
Total	5381	0.45*	101*/-	71,838

* Weighted average figures@ Carbon price of\$5/tC and 1\$ = Rs.45/-

(Sorcoe: Table 7&8 are from phase-I report of the project “Methodological issues in forestry mitigation a case studyof Kolar district by Ravindranath, et. al., 2005)

In yet another study on carbon sequestration levels of poplar block, poplar bund and the Eucalyptus bund plantations of Rupnagar District of Punjab, Gera et al, 2006 reported sequestration levels of 4.42, 2.46 and 2.15 tC per ha per year excluding the contribution of wood products. This was comparable to the results as reported for the earlier studies.

Overall, the above case studies have indicated that selected sequestration options seems to be attractive due to large scope of mitigating carbon and private investment by large number of farmers engaged in agriculture and orchard planting. However, it has to be acknowledged that certain barriers need to be overcome if the objectives are to be fully achieved. Such barriers to implementation include: inadequate extension activities by the Government on creating public awareness of the economic/environmental benefits of tree planting activities; unorganized markets; use of inappropriate planting material, planting & management techniques; absence of agro-foresters co-operatives; inadequate financial support and access to credit; weak institutional capabilities of forest department as regards technical manpower to effectively demonstrate raising, maintenance and harvesting of quality plantations and the exploitation of farmers by middlemen and industry.

These barriers would require appropriate action by all the stakeholders, particularly the Government and the growers. The policies should target at enabling the farmers to feel secure while exercising agro-forestry and orchard planting as an option to mitigate carbon. This will require a policy shift towards assisting the farmers with technical know-how, quality planting material, access to credit, formation of farmer's co-operatives and favorable market environment.

ENABLING CONDITIONS FOR DEVELOPMENT OF AGROFORESTRY CDM PROJECTS

There are bound to be challenging implications in formulating the agroforestry CDM projects. First and the foremost would be binding the farmers for pre-decided land use management practices for which they may not be prepared unless there are assured recurring benefits. It is therefore necessary to identify enabling conditions that ensure a flow of project induced benefits. For example the farmers may prefer raising of Mango or Litchi crops in the hope of getting the continuous flow of recurring benefits rather than going for a long rotation timber yielding tree species. It is therefore important to have the enabling conditions in place for success of such CDM type agroforestry projects.

Farmer's interest in tree planting activities is correlated with adequate food security, off-farm employment, lower risk, primary health & education facilities (Predo, 2000; Tyynella et al., 2002). They may not likely be solely interested in CDM type of projects and therefore it is imperative that such projects are integrated with overall development strategy of that area (Bass et al., 2000). The project should also help to strengthen the community institutions and build their capacity in relation to agroforestry planning & leadership, negotiation, concepts of C-sequestration etc. (CIFOR, 2000; Tipper, 2002). This may require adequate Policy level interventions on marketing, technical inputs such as certification, extension, formation of farmer's cooperatives and formulation of such projects which should form a part of overall development strategy of the area.

SMALL SCALE CDM PROJECT ACTIVITY

Modalities and procedures are simplified for small-scale A & R projects under CDM. Small scale project activities under CDM are those activities that are expected to result in net anthropogenic GHG removals by sinks of less than 16 Kilo tons of CO₂ E (2182 tC) annually and are developed or implemented by low-income communities and individuals. These projects have been provided relaxations in modalities and the procedures as bundling of very small projects allowed for PDD, provided total expected removals are less than 16 kilo tones of CO₂ev. Other relaxations for the small scale A & R projects include reduced requirements of PDD; Simplified baseline methodologies; simpler monitoring plans; same DOE may undertake validation, verification & certification and Leakage assessment is likely to also be simpler.

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Medieval Fort May Save Wild Asiatic Lions

***Raza H. Tehsin**

The Wild Asiatic Lion was distributed in large parts of Iran up to India till the 1850s. But gradually it declined and was wiped out from major part of this region. It completely vanished from Iran. Last confirmed report of its presence in Iran was in the 1930s. From most part in India, it disappeared in the early 20th century. It was confined to Junagarh forest where its fate was almost sealed. But the wise step taken by the Nawab of Junagarh saved it from extinction. He informed the British Governor General of India about the plight of the Asiatic Lion. The Governor General notified the British dignitaries and officers not to shoot Lion in the Gir forest. This was the turning point. Some even say that Nawab sent fictitiously low numbers of lions surviving in the Gir Forest to save the lions. Today about 300 Asiatic Lions are confined to the Gir forest of Gujarat.

Now the naturalists fear that if some natural calamity or disease erupts in this small number of Asiatic Lions, it may wipe out the entire population. This will be a colossal loss because we will lose a whole gene pool and, of course, a splendid animal. Naturalists are searching an alternate home for this species so that if some calamity befalls in a particular part containing the lion population, we still would be able to save the reservoir of this gene pool. It is a very painstaking and speculative project. The Kuno Sanctuary of Madhya Pradesh has been selected for it, which is being developed to the requirement of the Asiatic Lion, according to our understanding of them. Whether the wild species will adapt to the new home and propagate or will disperse and become a menace to human beings still remains an unanswered question. It happened in bygone days when some of the Maharajas of Indian states released lions in Central and United Provinces. None of them survived and some, which managed to live, became man-eaters and had to be eliminated.

Apart from rehabilitating the lions in an alternate home, some other solution should be considered. A small population of Wild Asiatic Lions should be kept in semi-wild conditions in a large enclosure. But to construct such a large enclosure with 12 feet high fence in rugged terrain of the jungle will be a very expensive and tedious exercise.

We have a very cheap and viable option for this. It is the 15th century fortress, Kumbhalgarh-built by Rana Kumbha of Mewar. A 36km long thick wall believed to be the second longest continuous wall in the world after the Great Wall of China encompasses this remarkable and impressive fort situated at an elevation of 3500 feet in the rugged landscape of the Aravali Hill Ranges. There are many temples inside the premises, which is 12sqkm. Situated at a distance of approximately 80km from the hot tourist destination Udaipur in southern Rajasthan, this fort is easily accessible.

Just at the entrance of this fort there is an old palace and a little habitation. A small wall just inside the fort delineating the palace and the habitation will give us a huge enclosure of 12 sqkm at the elevation of 3500 feet. In Africa lions very well survive at 5000 feet above sea level so the elevation is not a hindrance. Constructing this wall and repairing the damages in existing wall will ensure that no animal escapes from the enclosure. As the fort is very narrow at the entrance, the enclosure wall

to be constructed would not be very long. The enclosed space should be stocked with some ungulates, which are found in Kumbhalgarh Wildlife Sanctuary. When their population increases and they adopt to the new home a pride of wild Asiatic Lions should be released in this enclosure. Artificial water holes should be made at different places. To keep the lions well fed some domestic buffaloes should also be released periodically.

The project will also serve the purpose of archaeology, as the forest department will preserve the wall, which will subsequently protect the abandoned temples and other complexes that the archaeological department doesn't have the resources to maintain. The enclosure will restrict human entry, thereby decreasing loss by theft of idols etc.

The enclosure can be constructed in such a way that it serves a dual purpose. One, to save a sizable population of Asiatic Lion in almost wild conditions and two, to serve as a lion safari to generate revenue to make the project self sustainable.

Learning from the past, the vast area and the high walls of Kumbhalgarh fort could be a very low cost and viable option to protect and propagate the Wild Asiatic Lions- a living symbol of India's National emblem.

प्राणी मानव के आरोग्य रक्षक

डा. भास्कर एकनाथ यादव

प्राणी मनुष्य की तंदुरुस्ती के लिए अनेक प्रकार से सहायता करते हैं। प्रत्यक्ष रूप में आहार श्रृंखला द्वारा, दवाई के माध्यम से, ऊन, मधु और मोम का निर्माण करके, पशु पालन और जमीन उपजाऊ बनाने में एवं तालाब का पानी शुद्ध रखना आदि कामों में प्राणियों का कार्य महत्व पूर्ण है।

छोटी सुन्दर मछलियों को घर में जलकुंड में रखकर निहारने से मानसिक शान्ति तथा आनंद मिलता है। मछलियों में आसानी से हजम होने वाले प्रथिन तथा विटामिन ए, बी-4 (कोलीन), बी5, बी6, बी12 डी (कैल्सि फेराल), इ (टोकोफेराल), आयोडीन, नियासिन, पोटेशियम, सोडियम, फास्फरस, मैगनीज, ओमेगा-3 घटक रहते हैं। यह हृदयरोग निवारक तथा चमड़ी के विकार के उपचार हेतु उपयुक्त दवाई है। इसलिए मत्स्याहार उपयुक्त आहार हैं।

मेंढक पानी की सतह पर तैरने वाले कीटों को खा कर पानी को साफ रखते हैं। इस प्रकार मछलियाँ और मेंढक स्वच्छ पर्यावरण के द्योतक हैं। यह मच्छरों के लाखों अंडे खाकर मलेरिया और गिनी वर्म के निवारण में सहायता करते हैं। मेंढकों के पैरों की विदेश में मांग है लेकिन जैव विविधता के संरक्षण हेतु इनके निर्यात पर पाबंदी लगाई गई है।

मेंढकों की पीठ की चमड़ी के नीचे फैली हुई ग्रंथियों में उपयोगी रसायन पाए जाते हैं। उदाहरण सीरीन, सीरीडीन जैसे प्रतिजैविक केलीन तथा अन्य रसायन, मनुष्य को चर्म विकार, हृदय रोग, श्वसन अंगों के विकार आदि के लिए दवाई बनाने में गुणकारी सिद्ध हुए हैं।

सांप का जहर, जहर प्रतिरोधक बनाने में काम आता है। इस में खून पतला करने वाले घटक न्यरोटोक्सिन तथा सापटोटाक्सिन पाए जाते हैं जो रक्त ज्वर मरीज को अनस्थेशिया देने तथा कर्क रोग निवारक दवाई बनाने में काम आते हैं। गोह का तेल अनेक रोगों को नष्ट करता है लेकिन वन्य जीव संरक्षण अधिनियम के अनुसार इनको मारना अपराध है। छिपकली, कीटों को खाकर घर को स्वच्छ रखने में मदद करती है।

गाय, भैंस, बकरी का दूध सभी उम्र के लोगों के लिए पूर्ण आहार के रूप में उपयोगी है। दूध में प्रथिन, लैक्टोज, शर्करा, कैल्शियम और जीवन सत्त्व होते हैं। प्राणियों के मांस में अधिक प्रथिन पाए जाते हैं। लेकिन आधुनिक संशोधन द्वारा पता चला है कि शाकाहारी व्यक्ति अधिक स्वस्थ रहता है क्योंकि हरी सब्जियों में लोह तत्व और तंतूयुक्त घटक होते हैं। इस से पाचन क्रिया सुलभ होती है। गाय, भैंस का

गोबर भेड़ बकरियों की विष्ठा प्राकृतिक रूप से खाद देकर जमीन को उपजाऊ बनाती है। इस प्रकार प्रत्यक्ष रूप से प्राणी मानव की मदद करते हैं।

पशु पालन, कुकुट पालन तथा मत्स्य संवर्धन लाभप्रद देहाती व्यवसाय साबित हुए हैं।

उपयुक्त जीवाणु दूध का दही और छाछ में परिवर्तन करते हैं और यह शरीर की पाचन क्रिया को सुलभ रखने तथा जीवन सत्व उपलब्ध कराने में सहायता करते हैं।

केंचवे गीली जमीन के भीतर पहुँचकर विष्ठा के रूप में मिट्टी छोड़ते हैं। इस रसायन मुक्त मिट्टी से जमीन को खाद मिलती है। उसी प्रकार जुलुस व कान खजूरों की जमीन में हलचल होने के कारण बनाए हुए अनगिनत छिद्रों से जमीन उपजाऊ बनती है। जोंक के मुँह में जो ग्रंथियाँ हैं उसमें हिरूडीन पाया जाता है, यह रक्त गोठण क्रिया का प्रतिबंध करता है। पुराने जमाने में शरीर के आवयव से दूषित खून निकालने के लिए जोंकों का इस्तेमाल किया जाता था।

अश्वनाल केकड़ों के नीले खून में "लिसूलस अमिबोसाईट लायसेट" (एल.ए.एल.) रसायन होता है जो वैद्यकीय शास्त्र में विष परीक्षण में काम आता है। इन की हत्या पर जपान और अमरिका में प्रतिबंध लगाया गया है। लीरीस जाति के बिच्छू का जहर "सिस्टोसोमायसिस" ज्वर के कीटाणुओं को नष्ट करने में प्रभावी सिद्ध हुआ है।

मधुमक्खी मधु का संकलन करती है। इसके छत्तों से मोम मिलता है। मोम और मधु की अनेक आयुर्वेदीय उपयोगिताएँ हैं। भ्रमर का जहर जोड़ों के दर्द पर गुणकारी है। घरेलू मक्खी के मैगट अस्थि संसर्ग के जख्मों को सुखाने का काम करते हैं। अन्य मक्खियों के "मैगट" कॅनल में फैली सूक्ष्म वनस्पति खाकर पानी को साफ रखते हैं। यही कार्य कछुए, पानी में फैले हुए प्राणियों के मृत अवशेष खाकर करते हैं। कौआ और गिद्ध जमीन के पर्यावरण को साफ रखते हैं।

इस प्रकार सृष्टि में विविध प्रकार के प्राणी हैं जो मानव को प्रथिन, तेल, क्षार, जीवनसत्व, मधु, मोम और अन्य दवाई के संघटक उपलब्ध कराने में मदद करते हैं। कई प्राणी जमीन को उपजाऊ बनाकर, पानी को साफ रख कर तथा आरोग्य दायी पर्यावरण को मानव को अप्रत्यक्ष भेंट के रूप में देते हैं। इस लिए प्राणियों की हत्या पर रोक—थाम लगाकर उन के बारे में सद्भावना रखनी चाहिए क्योंकि हर प्राणी का प्राकृतिक संतुलन और मानव मात्र के अस्तित्व को बनाए रखने में अपना योगदान है।

आभार—ज्ञापन

लेखक, डॉ. अनिल.एस. महाबल, वैज्ञानिक—एफ, एवं प्रभारी अधिकारी, भारतीय प्राणी सर्वेक्षण, पश्चिमी प्रादेशिक केन्द्र पुणे का आभारी है।

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Saranda, Nature's Paradise

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Immortalised by legendary Satyajit Ray in his film "Aranger dinratri" and other bangla literature-the land of seven hundred hills in south west part of Jharkand is the most favoured haunt of tourists from Bengal, Orissa and other parts of the country, form the 825 sq.km of core area of "Singbhum Elephant Reserve". In 2002, 826. sqkm of Saranda Forest Division was declared as the core zone of "Singbhum Elephant Reserve" and the remainder area forms the buffer zone, where tribal people are allowed to follow their traditional way of life. The forests of Jharkhand are among the most extensive of peninsular India. At Saranda there are mixed deciduous and semi-evergreen forest, with Sal the dominant species and within an altitude range of 200-1000m- variety of other habitats can be found including bamboo, grassland, deep ravines and barren, rocky tracts. Numerous streams and rivers traverse the region and give rise to rapids, spectacular waterfalls and pools. The birdlife is fairly typical of central India and includes a number of species endemic to the peninsula, such as Malabar Pied Hornbill and Malabar Whistling Trush at the northeastern extreme of their range, while one or two Himalayan species such as Green billed Malkoha and Blue throated Barbet are near their southern limit. Being less than a day's journey from both Calcutta and Ranchi, respectively being West Bengal and Jharkhand's capital and from Jamshedpur, it can be easily reached from either.

Location

Access to Saranda is via Barajamda (A station on Chaibasa, Barbil Section of South East Railway) at the southeastern edge of the "Elephant Reserve" and Manoharpur and Jaraikela to its North. The Divisional Forest office at Chaibasa has to be visited first, if one wishes to stay at one of the Forest Rest Houses inside the Reserve. It can be reached by rail from Calcutta (300km to the east) or Jamshedpur-(60km to the east) or Ranchi (140km to the north), from where buses and jeeps are available. Barajamda can also be reached by train from Chaibasa (70km) and Kolkata (370 km), the most convenient train is Janshatabdi Express.

Accommodation

There are Forest Rest Houses in all the corners of the Elephant Reserve at Manoharpur, Baraiburu, Kiriburu and Jaraikela. Kiriburu is most popular because of its altitude of 1000m. the 50m water fall at Gagirathi, and another at Taybo are the nearby attraction for tourists. The Rest Houses are fairly basic and you need your own provisions, though the chowkidar will usually do the cooking. Reservation often need to be made well in advance with the Divisional Forest Officer, Saranda, PO Chaibasa, Chaibasa -833 201 Phone No. 06582-256366.

There is the more comfortable Officers Hostel at Kiriburu on the southwest edge of the Elephant reserve called Meghahatuburur. This is run by the SAIL. The Forest Rest Houses at Manoharpur, Jaraikela and Baraiburu can be booked with the Saranda Forest Division PO Chaibasa. The

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Saranda tourist lodge in Kiriburu is relatively cheap and can arrange jeep rides into the Reserve. There are several small lodges in Barajamda and Barbil also.

More expensive but pleasant and interesting accommodation is provided by the Saranda Resort a comfortable camp by the small river Karo near the village of Limtur, just south of village Baraiburu. Full catering is provided and treks into the jungle with native guides are good for nature watching. Reservation enquiry should be made with Saranda Resorts Pvt. Ltd. Barbil. A similar lodge cum camp is in Manoharpur, known as "Santoor" and organizes similar type of camping activities.

Activities

If possible, avoid weekends and public holidays in winters as many people come from Calcutta. A stay of at least three days is recommended with the best time being from November to April. Most of the rain fall occurs during June to October period and unmetalled roads become difficult to use. It can take quite a while for them to dry after the rains, with the more important roads to the waterfalls being repaired first. In winter the temperatures in the higher reaches of Saranda can be quite cool at night but become a fairly pleasant 20⁰C during the day. Except Kiriburu at other places temperatures climb to 40⁰C during May and June.

You need permits before you enter the Reserve. They can be obtained from the Divisional Forest Officer, Saranda, or the Range officer of forest, Manoharpur Jaraikela, Gua, Kiriburu-though the latter can only issue restricted permits for certain areas.

Most trips into the Reserve are undertaken by jeep. Try to make sure that you get a good one with functioning four wheel drive as the tracks are often extremely steep.

Bird-life of Saranda.

The avifauna of Saranda division are rich but not well documented. The earliest record of the birds was made by V Bal (1879) but thereafter hardly any noteworthy updating has been done. The species include; Cinnamon and Black Bitterns, Pied Harrier, Collared Falconet, Peregrine (Shaheen) Falcon, Red necked Falcon, Red and Painted Spurfowl, Red Jungle owl, Yellow wattled Lapwing, Pale capped pigeon, emerald Dove, Alexandrine and Plum headed Parakeets, Indian Cuckoo, Green billed Malkoha, Dusky Eagle owl, Brown Fish Owl, Jungle Owlet, Brown Hawk Owl, Grey Large tailed and Indian Nightjars, Crested Treeswift Chestnut headed and Blue bearded Bee eaters, Indian Grey and Malabar Pied and Great Hornbills, Brown headed, Lineated and blue throated Barbets, Greater and Lesser Yellonapes, Rufous, Fulvous breasted, Yellow fronted and Heart spotted Woodpeckers, Black headed and Black naped Orioles, White bellied, Bronzed, Spangled and Greater Racket tailed Drongos, Chestnut tailed Starling, Hill Myna, Large and Black winged Cukooshrikes, Scarlet and Long tailed Minivets, gold fronted Leafbird, Black crested Bulbul, Puff naped Monarch, Jungle Prinia, Greenish Warbler, White rumped Shama, white tailed Stonechat, Malabar Whistling Thrush. Scaly and Tickell Thrushes, Black-lored Tit, Chestnut bellied and velvet fronted Nuthatches, Thick billed Flowerpecker, Crimson Sunbird, Black headed Munia, Common Rosefinch and Crested bunting.

Other Wildlife.

Saranda harbours good numbers of mammals, but they can be hard to find. Tigers number very few on record with a slightly larger population of Leopards. Elephants number 150. Sambars are relatively common, perhaps more so than chital and mouse deer, Muntjac are relatively more, common. Rhesus Macaques and Grey Langur are the resident primates.

One may come across flying squirrel, Dhole, Wild Boar, four horned antelope, Indian Giant Squirrel, Indian Hare, Sloth Bear, Common Otter, Civets, Indian Fox, Jackal and Common Indian Mongoose. If you venture in late afternoon or early morning, near salt lick it can be rewarding.

At Kumdi and ligirda swamp you can see flying squirrels, Indian Pangolin, Indian Porcupine, Ratel, Hyena, Common Palm civet, Leopard and Jungle and Fishing Cats.

In the Elephant Reserve, reptiles to be seen are Monitor Lizard, Indian Rock Python, Indian Cobra, King Cobra etc. There are two nature interpretation centre at Kiriburu and Jaraikela, providing visitors with information and introduction to various aspects of environment, ecology, and wildlife.

Saranda is also home to more than 50 species of orchids besides numerous rare flora and those interested in botany are recommended to visit, this laboratory of nature.

SEASONAL BIO-DIVERSITY OF MOSQUITO FAUNA IN DIFFERENT AREAS OF DISTRICT JHANSI (U.P.) INDIA

C.L. BAHGEL, A.K. SRIVASTAV, V.K. SAHU AND MANOJ KUMAR GUPTA

ABSTRACT

Jhansi is an important district of Bundelkhand Region of Uttar Pradesh which shows different topographic condition and is endowed with very rich flora and fauna. In this backward area, mosquito faunal diversity is seen, which is responsible for transmitting dreaded diseases. During the entomological survey, various genera of mosquito were recorded viz., *Anopheles*, *Aedes*, *Culex* and *Armigera*. Hence bio-diversity of mosquito has been studied from March 2004 to February 2006 in different parts of district Jhansi. The densities of these species vary from one season to another, causing various diseases.

KEY WORDS: Jhansi, *Anopheles*, *Aedes*, *Culex*, *Armigera*, Seasonal, Density

INTRODUCTION

Jhansi is divisional headquarter of Bundelkhand, which is located from equator $25^{\circ}30'$ to $25^{\circ}27'$ latitude but in some places $78^{\circ}50'$ to $79^{\circ}52'$ longitude. Total area of Jhansi is 5024 sq.km. with nearly 1900000 population, out of which 31100 hectare is agriculture land from which 36% land is irrigated by various means viz. wells, canals, dams and rivers. Jhansi city and its periphery have some dams and ponds also. Some water collecting bodies are located in the heart of the city like Anitya Tal, Laxmi Tal and river Pahuj. These reservoirs are the main sources of breeding. Due to paucity of water, people collect water in different pots, cement tanks, mud pots, plastic buckets and coolers which are the breeding places for *Anopheles*, *aedes* and *Armigera* mosquitoes, which cause diseases like Malaria, Dengue, Chikungunia and Japanese encephalitis, respectively. The major vector of filarial is *Culex quinquefasciatus*. The abundance of certain common mosquito species in this area is based upon the topographic, climatic and man made environment for the survival of the mosquitoes.

The pioneer workers Giles and Thomson (1903) recorded notes on Culicidae of Dehradun while Thobald (1908) recorded Culicidae and Corethridae in Kolkatta with their descriptions on new genera and species. Barraud (1920, 1927 and 1928) has collected different Culicidae mosquito the genera *Armigera* and *Aedes* with their revision and classification. Kalara and Wattal (1965) made an entomological survey of Doon valley. Bhatia, Wattal and Kalara (1958) recorded the

seasonal prevalence of *Anopheles* species near New Delhi . Sarkar and Pranami (1966) studied the seasonal prevalence of common *Anopheles* species of different parts of Sagar Island. Yamda (1921) described the ten new species of *Aedes* found in Japan. Chand et-al (1993), studied the seasonality of indoor mosquitoes in broken forest ecosystem of north-west

Earlier works of Mahesh and Jauhari (1992, 2003 and 2004) studied the seasonal density of *Anopheles culcificies* and *Anopheles subpictus* in relation to climatic factors with mosquitos of forested areas of the Doon Valley. Recently Baghel and Srivastav (2004) recorded the intra-specific variations of *Anopheles subpictus* (Grassi 1899) reported from different localities of Jhansi (U.P), India.

MATERIAL AND METHODS

During the survey, four spots were chosen from different localities of Jhansi Urban: Civil lines, MehandiBag, Periubasu, Hansraj and Lahargrid. These species, include human dwelling. Cattle-sheds, mixed dwelling etc. and collection of mosquitoes were made from 6.00 am to 9.00am from different localities of Jhansi and it was made weekly by different techniques using torch light aspirator and also with the help of test tube.

Collected specimens were brought to the entomological lab and narcotized with choloroform. The identification of these specimens were made on the relevant literature of Christopher (1933), Wattal and Kalara (1961) and Das, Rajpal and Akiyama (1977)

RESULT AND DISCUSSION

The density and seasonal bio-diversity of mosquitoes were recorded in each month from March 2004 to February 2006 (Tables 01,02) Total 1409 specimen were collected from March 2004 to February 2005 belonging to the genera, *Anopheles*, *Culex*, *Aedes* and *Armigera*. In this group *Anopheles Culcificies*, *Anopheles annularis*, *Anopheles stephensi* and *Anopheles fluviatilis* were the vectors while *Anopheles subpictus* was non-vector species for malaria. There were 455 Anopheline specimens captured in the year. Out of them 72 and 383, males and females respectively. The ratio of male and female was 1:5.3% (Table – 01). The percentage of each Anopheline mosquito viz., *Anopheles culcificies*, *Anopheles annularis*, *Anopheies subpichus*, *Anopheles subpictus*, *Anopheles stephensi*, and *Anopheles fluviatilis* 15.3%, 14.7%, 30.9%, 24.4% and 12.3% respectively. *Anopheles subpichus* was highest in number followed by *Anopheles stephensi*, *Anopheles culcificies*, *Anopheles culcificies* and *Anopheles fluviatilis* (Table.01) The seasonal diversity recorded highest in the post monsoon season (recorded in the summer season) that was 1.8 PMHD (Fig 01). The peculiar diversity of *Anopheles annulairs* was observed in the month of November and it acts as the secondary vector of malaria due to light density in comparison to other species and low aprozoite rate.

Abundance of the mosquito fauna from March 2005 to February 2006 were 1640. Out of them 511 was *Anopheles*. The ratio of male and female was 1:63 while the percentage of this genus was 31.55. *Anopheles culicifacies* 19.0%, *Anopheles annularis* 14.5%, *Anopheles subpictus* 31.3%, *Anopheles stephensi* 19.2% while the *Anopheles fluviatilis* was 16.2%. The high density of *Anopheles subpictus* was recorded 31.3 and the lowest *Anopheles annularis* 14.5% (Table-01). *A. annularis* acts as the secondary vector of malaria. Seasonal bio-diversity of *Anopheles* was 21.5 PMHD, highest in post-monsoon season followed by monsoon 17.8, spring 8.12 and lowest density was recorded in the summer season 1.2 PMHD (Table-02). The total percentage of each Anopheline species of year 2005-2006 was calculated with the mosquito fauna of *Anopheles annularis*, *Anopheles fluviatilis* and *Anopheles stephensi* were 5.9%, 4.5%, 97%, 5.9% and 5.7% (Table 02). *Anopheles stephensi* was the main vector of malaria in Jhansi which was studied previously by Bhagel and Srivastav (2004) and Mahesh and Jauhari (2004) in Doon valley of Uttarakhand.

Five species of *Culex* were observed from 2004 March to February 2005 viz. *Culex quinquefasciatus*, *Culex gelidu*, *Culex equidesmus*, *Culex vishuni* and *Culex whitmorei*. *Culex* were 509 in number with 36.1% of the total mosquito fauna showing ratio of male and female 1:7.5, 1:63, 1:57, 1:3.9 and 1:4 respectively (Table 01). The highest population of *Culex quinquefasciatus* was 45.3% while the lowest was 5.8 of *Culex whitmorei*. The data was nearly same as that of Mahesh and Jauhari (1992, 2000 and 2003). Only *Culex quinquefasciatus* acts as the major vector of *Filaria* and remaining other species act as the minor vector of Japanese encephalitis. These diseases are fatal and dreadful for human beings.

We also observed the peak population in the month of September. Seasonal density was also observed and recorded highest in the monsoon (16.6) followed by post monsoon (16.0) spring season (13.3) and in winter season (6.9) while the lowest 4.0 PMHD in the summer season (Figure 01). Such type of observations was carried out by Kalara and Wattal (1965) in Doon valley.

The total 596 *Culex* mosquitoes were collected from March 2005 to February 2006. The ratio of male and female of each species 1:8, 1:7, 1:10.2, 1:3.3 and 1:2.3 (Table-02). The observation showed the *Culex* was 36.7% of the total mosquito fauna with highest population 44.2 of *Culex quinquefasciatus*: lowest was of *Culex whitmorei* 5.0%. The highest density 22.0 was in the post-monsoon followed by monsoon 17.0, spring 15.2 and in winter 8.1 while the minimum density was also recorded 4.0 PMHD in the summer season (Figure -01). Present year showed higher

density than March 2004 to February 2005 except summer. Our observation is similar as that of Thomson (1903).

In the course of the survey 142 *Aedes* were captures from March 2004 to 2005. In them *Aedes aegypti* and *Aedes albopictus* were identified. These species were vectors of dengue and Chikunguniya. The former one species was 73.2% and last one was 26.7% of its genera (Table 01). The ratio of male and female of above species was 1: 6.5. Total percentage of this genus (Table.01) was nearly 10.2% of the total mosquito fauna. The seasonal density was highest 7.2 in post monsoon followed by monsoon 4.8, in spring 1.6 and in winter it was 1.5, in spring 1.0 while the lowest density was in the summer season (Figure-01).

The ratio of male and female of above species was 1:6.5. Total percentage of this genus (Table.01) was nearly 10.2% of the total mosquito fauna. The seasonal density was highest 7.2 in post monsoon followed by monsoon 3.6, winter 3.0 and in spring 1.6 while the lowest density 1.00(PHMD) in the summer season (Figure-01).

Total 183 *Aedes* mosquito were collected from March 2005 to February 2006 which was nearly 11.4% of the total mosquito fauna. During the survey three *Aedes* species were identified viz. *Aedes aegypti*, *Aedes albopictus* and *Aedes vittatus*. The highest population, 60.0% *Aedes aegypti* followed by *Aedes vittatus* 21.6%, while the lowest 17.2% of *Aedes albopictus* (Table-02). One more important phenomenon observed that *Aedes vittatus* was not found in the previous year. Seasonal density was highest in post monsoon followed by monsoon, winter and spring season 8.1, 7.5, 1.9 and 1.8 PMHD respectively (Figure-02) while the lowest density recorded 1.5 PMHD in summer season. It was nearly the same as that of Yamada (1921), who described ten new species of *Aedes* genera found in Japan.

Another genus *Armigera* of the family Culcidae was also observed in this district (the course of survey from March 2004 to February 2006). There were two main species viz. *Armigera obturbans* and *Armigera kuchingensis*.

The total of 304 specimens of this genera captured in the period from 2004 March to February 2005 in which *Armigera obturbans* 58.9% while another species *Armigera kuchingensis* was

41.1% of its genera. The highest density of this species was in post monsoon, 12.0 PMHD followed by monsoon, spring season and winter season 9.6, 6.8 and 3.2 PMHD respectively while the minimum density 2.1 PMHD in summer season (Figure 01). The ratio of male and female was 1: 7.8 (Table 01)

The total 328 specimens of *Armigera* were captured in March 2005 to February 2006 with above two species of *Armigera*. *Armigera* observed 1:8.0. Seasonal density of each species was increased in each season from March 2005 to February 2006. It was highest in Post monsoon followed by monsoon, spring and winter season that were 12.3, 10.0, 7.2 and 4.0 (PMHD) respectively. While in summer it was very low that was 3.3 PMHD (Figure 01).

Comparative study of density was also made in all genera excluding *Anopheles* and found highest in March 2005 to February 2006 than that of previous year. Seasonal density was highest in post monsoon in both the years but increased in March 2005 to February 2006 (Figure 02). The main thing observed was that one more species of *Aedes* was identified in the year March, 2005 to February 2006.

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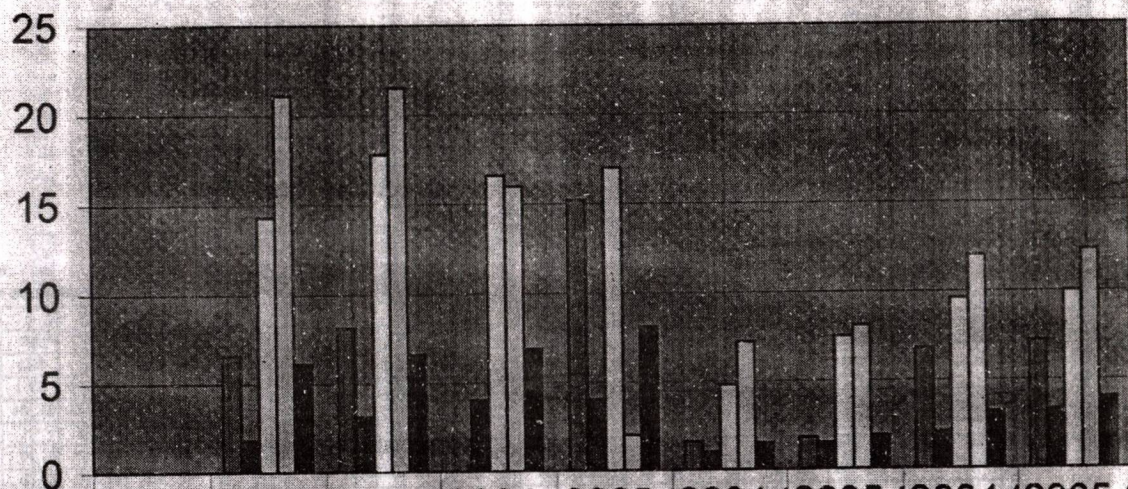
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a, S

Av.Rs.in M/F-Average of male and Female
Spg -Specieswise % in genera
%spp in Population
%pop of Genera

Table 02 : with Histogram shows the seasonal density of two years from 2004-05 and 2005-06



	2004-2005- Year Anophelese		2004-2005- Year Culex		2004-2005- Year Aedes		2004-2005- Year Armigera	
■ Spring Season	6.6	8.12	0	15.2	1.6	1.8	6.8	7.2
■ Summer Season	1.8	3.12	4	4	1	1.5	2.1	3.3
□ Monsoon Season	14.3	17.8	16.6	17	4.8	7.5	9.6	10
□ Postmonsoon Season	21.1	21.5	16	2	7.2	8.1	12	12.3
■ Winter Season	6.1	6.6	6.9	8.1	1.5	1.9	3.2	4

*From the Archives of "Cheetal"***Census Techniques in Wild Life Management*****J. JUAN SPILLETT AND GEORGE H. KELKER****Summary**

We have discussed briefly a few of the basic factors to be considered in conducting a wild life census. Terminology and the application and basic computations for the Strip Method have also been briefly considered. In no way should the paper be considered a complete treatise on wild life census methods, nor the methods discussed as inviolate rules to be strictly adhered to in all cases. Sound judgement must be exercised and some experimentation is necessary in conducting all wild life census work. It should be constantly remembered that a single census does not provide all the answers for a wildlife conservation program. Only by carefully and continuously collecting and analyzing such data over an extended period of time can definitive conservation measures be applied to preserve and protect one of India's priceless natural resources- its irreplaceable wild life.

A census is an enumeration of animals on a given area, at a particular time, by a method the results of which may be analyzed statistically. The management of wild life is based upon a knowledge of numerous factors, two of the most important of which are : (1) kinds of animals (qualitative factors), and (2) numbers of each kind (quantitative factors). Several census methods are available to compute directly the total numbers and the relative proportions of adult and yearling males and females and the number of young. Such data may show gains and losses as well as the success of the mating season as measured by the annual production of young.

The manner of conducting a wild life survey depends upon (1) the species being censused,, (2) the topographic and vegetative conditions of the particular area, (3) the recency and adequacy of any previous surveys, (4) the availability of trained personnel, and (5) the intensity of management planned for the future. The greater the intensity, the greater is the need for increasing the thoroughness of the census. Each of the numerous census methods has advantages and disadvantages.

Wildlife populations do not remain static. Increases or decreases often occur rapidly and a single census rarely provides answers to questions about several aspects of the population . Therefore, data should be collected and analyzed continuously in order that current conservation measures may meet the demands of changing situations. In short, an accurate census of the total wild life population is essential in any conservation program, but it is also one of the most difficult tasks to perform. We shall now consider some procedural aspects of conducting a census.

General Considerations: The primary qualification for personnel to conduct a census is the ability to readily identify animals in the field to species, sex and relative age class, i.e., adult, yearling or young of the year. The importance of animal activity, as well as those factors causing variation in activity, must also be recognized. Included are such factors as: the species to be counted; time of day; weather, including temperature and relative humidity; seasonal habits; and breeding activities. For example, blackbuck commonly inhabit open grasslands, whereas sambar are found in forest; most ungulates tend to feed during early morning and evening hours and rest during much of the day; however, when it is cloudy many animals feed later in the morning than when it is clear; storms or sudden change in the weather also affect the animals patterns of activity, some species follow seasonal patterns of migration, which must be considered or the species may be absent from the census area, or appear overly abundant. However, migratory species such as the Kashmir stag, or species such as swamp deer and chital that group together during the breeding season, may present the advantage of conducting a direct count

While field glasses are almost essential, a lack thereof should not deter a determined investigator. The number of people conducting the census must be considered so that each member of the group is sufficiently trained and instructed to insure that the census will be coordinated and will be conducted in an efficient and orderly manner. However, for ease in presentation, it will be assumed throughout this paper that one person is conducting the census. If more individuals are to be employed simultaneously in the same or adjacent areas, necessary modification or allowances will have to be made to avoid duplicate counts of the same animals. The drive is one of the few methods using much manpower.

Terminology: The need for a common language for communicating the results of a census was recognized by Wight (1931) who stated:

One of the basic problems in game management is the development of methods by which a game census may be rapidly and accurately made. A satisfactory method must be quantitative and standardized and the results should be expressed in birds-per-acre for each cover type and season.

Some common terms used in conducting a census are : (1) head, considered merely as one of a number (i.e., ten head of chital), (2) animal density, the number of animals per a given area, (3) relative abundance, a measure or indices used when density cannot be determined (i.e., "abundant", "common", "rare", etc.) or time-relative (i.e., animals seen per hour, etc.) or the percentages of various kinds seen, (4) cover map, a map depicting the different types of vegetation on specific areas, (5) cover type, a broad classification of vegetation types (i.e., desert, grassland, forest, etc.), (6) vegetation type, an easily recognized biotic community (i.e., an evergreen sal, bamboo or mixed forest, etc.), and (7) cruise, to systematically cover an area, generally by moving hither and thither.

The various ways of expressing the density of one or two species on a given area and also their combined abundance is presented by Hill and Kimball, 1948 (Table 1).

Table 1

Various ways to express the density of animals populations. Expressed in total numbers.

Form of expression to indicate density	Total density	Density by Species	
		Species I 40%	Species II.60%
Acres per animal	25.00	-	-
Animals per acre	0.04	0.016	0.024
Animals per 100 acres	4.00	1.60	2.40
Animals per sq.mile (640 A)	25.60	10.24	15.36
Animals per 1,000 acres	40.00	16.0	24.0

Direct Counts: The most desirable type of census and the most accurate is a direct count of all the animals inhabiting the census area. This is sometimes possible with species that normally inhabit or visit open grassland or desert areas or which congregate into large herds during certain seasons of the year. For example, the blackbuck and the gazelle (chinkara) commonly inhabit open and flat country. With the aid of field glasses, or preferably a 20X spotting scope, very accurate counts of animals in these areas may often be made. On several occasions while Dr. George Schaller and one of us (J.S) were conducting a wild life census of the Keoladeo Ghana Sanctuary near Bharatpur in February, we were able to count the entire population of blackbuck. Admittedly, this is a small herd. However, during a two year study of the pronghorn antelope in the deserts of Wyoming (USA), the same author has made accurate counts over extensive areas and of herds numbering over 200.

Some species, such as swamp deer and chital, frequently congregate on open meadows or "maidans" during certain seasons of the year. For example, in Kanha National Park the swamp deer are all on the maidan adjacent to Kanha village in March and April. In July most, if not all, of the chital in the Kanha valley congregate in a few large herds on the same maidan. During these months, one person, working for several days, might obtain accurate counts of both species. The Kashmir stag winters in a relatively restricted area in the Vale of Kashmir east of Srinagar. A direct count of this species could be made there in winter. However, in many situations and with many species it is neither feasible, nor possible, to make a direct count of every animal in an area. Under such difficulties other systematic methods which lend themselves to the terrain and the species being surveyed should be used to obtain the most accurate estimate of the population, or its components.

The Strip Method: Numerous census methods are described in the literature, which involve complicated mathematics and which were developed for a particular species under relatively specific conditions. However, the majority of these are based upon, or are modifications of, the strip Method.

In principle the Strip Method is identical to the forester's method of cruising timber, that is, the number of animals counted on the strip is considered to be directly proportional to the total number, as the area of the strip is to the total area. The principal difference, however, is that the timber

cruiser decides on the percent of the total area to cruise *before* entering the forest; and then calculates the width of strip necessary to give the area needed, the length per section being known; whereas the animal "cruiser" determines the width of the strip *after* returning from the field by one of the methods described below. Furthermore, the timber cruiser maps each different forest type as he tallies the trees, and notes the number of chains (yards or other measurement of distance) covered in that particular type. Similarly, the animal ecologist should record the vegetative types encountered along the strip. It would be better, if possible, for him to have a map showing the vegetative cover before he enters the area, and to plot the location of the animals seen on this map. A "cover map" is almost indispensable for census work. When animals sighted are plotted on this map, it not only shows the preferred distribution of each species by vegetation types, but it also shows the relative frequency by which a species may be encountered in these types during that particular time of year.

The principle of the Strip Method may be expressed by the following equation:

$$\frac{\text{Area of the Strip Covered}}{\text{Total Area of Censusing}} = \frac{\text{Animals on strip}}{\text{Animals on whole area}} \quad \text{or} \quad \frac{a}{A} = \frac{h}{P} \quad \text{Formula 1}$$

- (1) a/A gives per cent of area surveyed, or "percent of survey".
- (2) a/h gives the number of unit areas per animal
- (3) $A/a // h/p$ gives the number of "animal-squares" in the whole area
- (4) ahP/a (derived from 3) gives the total estimated population for given area.

Therefore, (5) $P = Ah/a$

FORMULA II

But a = length of strip times width or $g \times w$

And w = 2 times the flushing distance (right angle distance of the animal from the line of travel followed by the censor), or $2D$

Therefore, $a = g \times 2D$

Substituting in Formula II for a

$$P = Ah/g \times 2D \quad \text{FORMULA III}$$

This explains King's formula where A is given in square yards,

g is given in linear yards,

D is given in linear yards, and

h is number (head) of one species seen

While feet, chains, rods or other measurements may also be used, this complicates the arithmetic.

However, it is usually more convenient to at least keep the flushing distance in yards, because a yard is approximately a step for most people for distances under 100 feet.

An equation which is easier to use is the following:

$$d = 8my/11h \quad \text{FORMULA IV}$$

Where d = density in terms of acres-per-head for the district surveyed

H = number of head counted

M = number of miles in the transect line

y = number of yard the animal seen is from the transect line, or the flushing distance (See recording the flushing distance)

Thus, the total population estimate for the total area expressed in acres (A) is $P = \text{Formula V}$

Note that y is the chosen flushing distance that includes all of h head. Yet, y is rarely that greatest distance at which some animal are occasionally seen. (See computing the annual density)

Recording the Flushing Distance: There are two distinct ways to record the distance of the animal from the censor. One method is to record the distance from the spot vacated by the animal at the time of disturbance to the spot where the censor was when he disturbed the animal, frequently called the *long distance* or "radius of disturbance". The second method is to take the shortest distance from the censor's path of travel to the spot just vacated by the animal. This is the perpendicular or right angle distance to the line of travel, frequently referred to as the *short distance*. This is distance y in Formula IV

Although some authors advocate the use of the *long flushing distance*, it has disadvantages which may be overcome by using the *short distance*. A criticism of this method is that the observer, by moving along the transect line or line of travel, will lose sight of the exact spot where the animal starts or flushes, or, alternatively, if he goes directly to that spot and paces back, he may miss his line of travel. Therefore, skill is required and only persons having sufficient training and who show special aptitude should be allowed to perform this basic operation in wild life management. Both the beginner and the more experienced worker, particularly in densely forested areas, should carry a compass in order to check, at least periodically, the line of travel and to avoid overlaps or "skips" in their transects. The beginner may also use a compass to take the angle or line on which he flushed animals, and pace the distance directly. This is an accurate but time consuming method for obtaining the short distance, the justification of which is probably restricted in most cases to research.

Computing the Animal Density: To determine the acres-per-animal ratio, the count of animals and the area of the strip surveyed must be known. The length of the strip should be known. Then, the width may be determined by one of the following methods:

1. Use the maximum distance recorded for either side.
2. Average all flushing distances.
3. Halfway point between maximum distance and averaged distance.
4. Use several intermediate distances (i.e., between zero and maximum), and choose one which seems to give the best sampling.

The advantage of the first method is that it requires the least arithmetic. Its disadvantages is that it almost always gives an underestimate. It is probable that some animals near the maximum flushing distance recorded are never detected. Other conditions equal, the maximum distance at which various species are seen is influenced mainly by the kind and density of cover.

The second method is easy and convenient. It averages discrepancies and smooths out irregularities due to variations in cover conditions. However, its principal fault is that it usually overestimates the population, since all animals beyond the average flushing distance are included *inside* it. It may be argued that for each animal seen beyond the average flushing distance, there was one missed inside it. This is a fallacious argument. The shorter the distance an animal is from the censor's line of travel, the less probability that the animal will not be seen.

Perhaps the third method, or halfway point between the average of all flushing distances and the maximum flushing distance, will give a good estimate of the number of animals of one species on a strip. However, with great variation in cover (i.e., forest versus maidan) the population may be overestimated or underestimated, depending upon cover conditions. Therefore, the fourth method is generally recommended.

The fourth method requires the most computations, but demonstrates the flaws in the assumptions made by the first three methods. It is also difficult to choose the width which gives the best sampling estimate. Several widths at which animals were recorded are arbitrarily chosen and only those animals seen inside each of the widths are included in each width classification. Thus, there is a larger number of animals included as the width is increased, but the increase in ratio between animals and acres is not proportional. Therefore, by using a number of different computations or width classifications, it is frequently shown that method one gives an underestimate, method two an overestimate, and method three perhaps either an underestimate or an overestimate of the population.

The advantage of this method of calculating population density is that the extreme distances are omitted, thereby eliminating the variation in cover, as well as in individual animal responses. It shows validity of sampling by agreement or disagreement of the ratios.

The disadvantages are : (1) it is more time consuming (but this fault should be disregarded if one wants the best survey possible), and (2) personal judgement is involved in choice of ratios of acres per head. This latter fault is immaterial if the ratios agree closely. However, if they are not in close agreement, it indicates that the sampling of the population was insufficient, and that any flushing distance used, whether it is the average of all, or is the maximum, is only a guess. Therefore, it is advisable to repeat the survey if important plans are being considered. Even if a survey is not repeated, this method will show a possible maximum and a possible minimum limit of the population. An example of this method is given below (Table 2).

Table 2
A count of deer in a paddock in Ontario, Canada.

Distance Deer were seen from line of travel	Total No. Deer seen inside that distance	Acres per head of deer	Estimated population per square mile
125 yards	36	9.24	70
75 yards	34	5.85	110
50 yards	33	4.00	160
35 yards	26	3.545	180

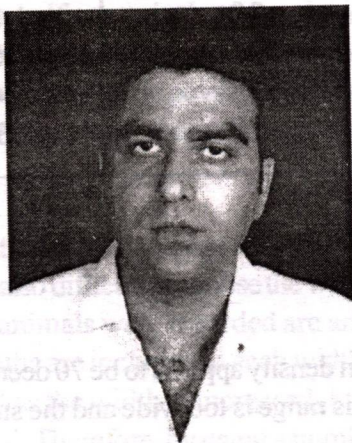
Based on these data, the minimum density appears to be 70 deer per square mile and the maximum density 180 head. Obviously, this range is too wide and the survey should have been repeated.

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"Cheetal" quarterly News

***Life Member of Wildlife Preservation Society appointed
Honorary Wildlife Warden of Rajaji National Park in
Uttarakhand***



Mr. Rajeev Mehta, resident of Hardwar, a young & dynamic life member of WPSI has been appointed as Honorary Wildlife Warden of Rajaji National Park in Uttarakhand. Rajeev is a keen wildlife conservationist and keen nature photographer. Solo exhibitions of his photographs were organised at Dehradun & Chandigarh which were highly appreciated by Nature lovers. His photographs were also displayed in Wildlife & Nature Photo Exhibition organised by WWF - India at India Habitat Centre N.Delhi during Oct. 2008, wildlife week alongwith other top Wildlife Photographers. He has visited many a protected Areas of the country and was also member of outgoing Wildlife Advisory Committee of Uttarakhand. His interest in Wildlife Conservation in Rajaji N.P. is well known. He participates in the monsoon patrolling of the Park with its frontline staff to argument the vigilance and morale of the staff. We congratulate Rajeev Mehta and wish him success in his new mission.

Wildlife Preservation Society of India, continues to attract more member.

During the quarter following 5 new members were added to the society.

One annual members Shri. P.K. Bajpai, Reader Department of Zoology, Kanpur was converted to life member. The High Altitude Zoological Field Station, ZSI solan (HP), annual member of the society was converted to Institutional Life Member. One student member Swati Nagar of Dehradun was also converted as a annual member.

Following institutional, annual and student members of the society have opted to become institutional life, life and annual members. They are hereby converted to institutional life, Life and annual members from the date noted against each :-

Name	Present Status	Converted to
1. High Altitude Zoological Field Station Zoological Survey of India, SOLAN - 173211, SAPROON, Himachal Pradesh -	Annual Member	Institutional Life Member (2009-2010)
2. Shri P.K. Bajpai, Reader, Department of Zoology, House No. 8/28 Arya Nagar, KANPUR - 208002 Uttar Pradesh	Annual Member	Life Member (2009-2010)
3 Swati Nagar, 99, Govind Garh State Bank Colony Dehradun-248001 Uttarakhand		Annual Member (1-04-2009)

Following new members are welcome to the Society :

1. Dr. S.P. Badola,
Srimati Bhawan
Upper Kalabarh
Kotdwar-246149
Pauri-Garhwal
Uttarakhand
Annual Member
(11-04-2009)
2. Sri Sudhir Kumar
C/o Sri S.S Chadha
162/10, Near Prem Mandir,
Civil Line, Roorkee
Hardwar, Uttarakhand
Annual Member
(1-05-2009)
3. Dr. Kusum Singh,
Lecturer
Department of Zoology,
Bundelkhand University,
JHANSI,
Uttar Pradesh
Annual Member
(1-05-2009)
4. Dr. S.N. Khattri
Reader in Zoology
(D.B.S. College
KANPUR)
126/73, G Block,
Govind Nagar,
KANPUR-208006,
Uttar Pradesh
Annual Member
(25-05-2009)
5. Dr. Shail Vajpai,
Lecturer,
290 'W' Block,
Keshav Nagar,
KANPUR-208014
Uttar Pradesh
Annual Member
(25-05-2009)

Gas that saved ozone layer making world warmer.

Research Shows Replacements of Ozone-destroying CFCs are powerful Greenhouse Gases.

The Green movement's greatest triumph- the abolition of ozone-destroying CFC gases in the 1980s-may become its biggest embarrassment after research showing that their replacements are sharply accelerating global warming.

CFC, or chlorofluoro-carbon, gases were widely deployed in air-conditioning and refrigeration units before they were found to destroy the ozone layer and banned under the 1987 Montreal Protocol.

They were replaced by HFCs-hydrofluorocarbons-gases which have far less effect on ozone but which have since been revealed as extremely powerful greenhouse gases.

A tonne of HFC-23 has the same global warming potential as 14,800 tonnes of CO₂. A tonne of HFC-134a-, widely used in vehicle air-conditioning units, is equivalent to 1,430 tonnes of CO₂. The problem has been increased by the rising demand for refrigeration and air-conditioning because of economic expansion and population growth in Asia.

A study out this week will warn that, by 2050, HFCs could account for up to 19% of global warming. "By 2050, the contribution of HFCs to global warming will be more than that of current global CO₂ emissions from houses and office buildings," said Guus Velders of the Netherlands Environmental Assessment Agency, who conducted the research.

"The contribution of HFCs to global warming is currently small, but can increase to between 9% and 19% of the total CO₂ contribution by 2050."

He found that by 2050 the demand for HFCs was likely to have increased by 800% compared with today's figures.

A separate study conducted by the Environmental Investigation Agency, a campaign group, found the biggest source of HFC emissions was air-conditioning in vehicles.

Air-conditioning and refrigeration units leak the HFC coolants into the air, with about 30% lost each year. This means that HFC production has to rise to keep pace with new units and losses from existing ones.

The EIA said: "Atmospheric concentrations of hydrofluoro-carbons are rising at about 15% per year, faster than any of the other (main) greenhouse gases, even though there are viable alternatives available that do much less damage."

In 2005, global production of HFCs was estimated at 280,000 tonnes, roughly equivalent to half a billion tonnes of CO₂. The Inter-governmental Panel on Climate Change predicts this will rise to the equivalent of 1.2 billion tonnes of CO₂ by 2015.

Source : The Times of India, New Delhi, June 23, 2009

Study: Indians are world's 'greenest'

Country's Frugal ways and modest means puts it atop NatGeo's Greendex

Washington: That cold water bath many Indians take because there is no electricity.. that earthen pot matka they use because they can't afford a fridge.. and the long walk to work and back because private transport is expensive and public transport shoddy. Well, there's an upside to the hard life.

Indians may be green with envy at the consumption-drive lifestyle in the west, but their own frugal ways and modest means has catapulted them to the top spot in the world's Green index, making them the friendliest denizens of Planet Earth. The second annual survey conducted by National Geographic Society and the international polling firm GlobeScan on environmentally sustainable behavior, results of which were released recently, showed that Indian consumers have overtaken Brazilians to take the top spot with a Greendex score of 59.5. Chinese retained the third spot with 55.2.

At the bottom end of the ladder in the 17-country survey were over-consumptive Americans (last with 43.7), Canadians (43.5) and Japanese (49.3).

So what put Indians at the top of the Green ladder? Well, it was driven by above-average performance on all four sub-indices, including first-place rankings for food and goods.

Indians are the most frequent consumers of self-grown food, with 35% eating this type of food several times a week or daily. They are also the least frequent consumers of beef, which requires greater energy to grow. Only 22% of Indians consume beef weekly compared with an average of 63% for the 17 countries surveyed.

Indian consumers also topped the goods sub-index score. Their top-placement status is due in part to having lower than average rates of ownership for large appliances and electronics, and having some of the highest rates for buying used goods, avoiding environmentally unfriendly products and excessive packaging, and buying environmentally friendly products.

Indian consumers continue to rank third on the transportation sub-index. Based on the fact that they are second most likely to live close to their usual destinations and second least likely to own a car or truck (54%). Among those that do drive, Indians tend to have lower than average annual mileage rates. They are the most likely to own and use motorcycles or scooter and second most likely to drive a compact car, after Mexicans. In addition, walking or riding a bike is up 7 points from the past year (to 57%).

On housing, Indian consumers rank second only to Brazilian consumers. Factors contributing to their high ranking include a low incidence of having home heating (41%) and hot running water (38%) and a high incidence of using on-demand electric water heating (45% among those with hot running water), and using solar energy to heat water (15%). However there are plenty of signs that India's Green-ness, which seems driven more out of compulsion than conviction, might not last long. Indians are the most likely to say they intend to acquire a motorized vehicle in the next year (58%).

Source : The Times of India, New Delhi, May 15, 2009

Scientists warn polar ice is melting faster than earlier thought

Over a century ago, it took 34 months for the Norwegian explorer Fridtjof Nansen to free his ship, *Fram*, which was frozen into the Arctic ice. But the scientists of the International Polar Year (IPY) could get their vessel, *Tara*, freeze in and out of the ice in 14 months flat.

"The probable reasons are warmer ocean water, thinner ice and stronger than usual winds," said Prof. David Carlson, director at the International Programme Office of IPY, global scientific research campaign over 2007-08.

On Wednesday, an IPY report, indicated that such findings of unprecedented, unforeseen and rapid ice melt could rewrite some projections about the impact of global warming for worse.

The state of the Polar Research, a report from the Interantinoal Council for Science/World Meteorological Organization (WMO) Joint Committee for the IPY, makes a few things clear. The Greenland and the Antarctic ice sheets are losing mass and thus raising sea levels, and the rate of ice loss from Greenland is growing, it said. Besides, warming in the Antarctic is more widespread than thought prior to IPY.

"What happens in the polar regions affects the rest of the world and concerns us all." The statement warned. "Ocean currents, winds and sea ice had all changed, beyond our expectations," Carlson said. The findings make the fourth assessment report (AR4) of the UN Intergovernmental Panel on Climate Change (IPCC) outdated in some aspects. "For Greenland, definitely yes," Carlson said. "For Antarctica, IPCC AR 4 had large uncertainty, now we have less uncertainty."

Rapid ice melt could mean more rise in the sea levels. IPCC's best estimate for a "low scenario" air warming in the 21st century is 1.8°C and in turn a sea level rise in the range of 18 to 38cm. Green groups call it a gross underestimate and cite the case of rapid polar ice melt in heated arguments.

Global warming has more disaster spin-offs. Warming seas could send more moisture up and make storms fiercer. The intensity of cyclones, including over the Indian Ocean, is increasing. The subtle changes in ocean conditions and the ocean-atmosphere flows of heat and moisture influence the eventual strength and trajectories of major storms in the North Atlantic, the IPY report noted.

Already there is evidence of stronger storms across the North Atlantic towards Europe, compared with long-term averages. "The intensities seem to increase and the storm tracks seem to shift," Carlson said. "If the changes in the polar region affect the trajectory of the narrow and strong westerly winds in the mid-latitudes, then they might influence the Indian monsoon," said Prof. J Srinivasan, of the Centre for Atmospheric and Oceanic Sciences at the Indian Institute of Science. The polar scientists have called for more studies.

DANGER SIGNS

Satellite data and automated weather stations indicate that "the warming we see in the peninsula (Antarctic) also extends all the way down to what is called west Antarctica," Colin Summerhayes, executive director of the Britain-based Scientific Committee on Antarctic Research and a member of International polar year's steering committee, said.

"That's unusual and unexpected. The biggest west Antarctic glacier, the Pine Island Glacier, is moving 40 percent faster than it was in the 1970s, discharging water and ice more rapidly into the ocean," Summerhayes said. The Smith Glacier, also in west Antarctica, is moving 83 percent faster than it did in 1992, he said. All the glaciers in the area together lose a total of around 103 billion tons per year because the discharge is much greater than the new snowfall, he said. "That's equivalent to the current mass loss from the whole of the Greenland ice sheet," he said. "We didn't realize it was moving that fast."

Antarctica's average annual temperature was increased by about 0.56 degrees Celsius since 1957, but is still 45.6 degrees Celsius below zero, according to a recent study by Eric Steig of the University of Washington. "If the west Antarctica sheet collapses, then we're looking at a sea level rise between 1 meter and 1.5 meters," Summerhayes said.

Source : Mail Today, New Delhi, February 26, 2009

No choice on conserving nature.

Nobel Peace Prize winner Eric Chivian was given the world one more reason to preserve biodiversity. While most views take the keep-nature-intact approach, Chivian, founder and director of the Centre for Health and Global Environment in the US, says homo sapiens have a lot to learn from different marvels of nature.

"We have such an intimate connection with nature that we really don't have a choice about protecting it," he said in a talk with IITians held through video conferencing. His book, *Sustaining Life* seeks to etch this reality in graphic depth.

For instance, the polar bear, among the seven most endangered species on earth, may become extinct by the end of this century because of the melting of the Arctic ice. Polar bears are used to prolonged immobility for almost half a year. But while post-menopausal women could lose one-third of their bones after five months of being immobile, the hibernating polar males survive without developing osteoporosis or heart problems. We will lose this knowledge if they die, Chivian points out.

Similarly, some frogs have anti-microbial, compounds that protect them from bacteria and fungi. At a time when medical science is facing a growing crisis of resistant microbes such as those which survive TB drugs, studying these frogs could help us evolve strategies to fight pathogens. Tadpoles, for instance, have compounds to control acidity which causes peptic ulcers in human beings.

Source : Mail Today, New Delhi, February 116, 2009

Creation of Involate Critical Wildlife Habitats Finalised

NEW DELHI : A blueprint to create inviolate critical wildlife habitats (CWHs) across the country has been finalised by the environment and forests ministry. Unlike the existing protected areas - national parks and sanctuaries - the ministry has suggested a set of guidelines based on scientific criteria to establish the habitats.

This is an important step to provide an exclusive space to wildlife when the Forest Rights Act gets operationalised. Under the Act, which is meant to formally recognise rights to forest dwellers, only areas declared as CWHs can be granted inviolate status - sans human presence. Even existing protected areas will have to be re-evaluated under these norms to declare them inviolate if they fall within the set criteria.

Priority has been given to tiger-bearing forests. Within 30 days of the notification of guidelines and formation of state level committees, all regions with a breeding tiger density would be demarcated. The ministry, in consultation with chief wildlife wardens and experts at Wildlife Institute of India, has suggested that for every 20 breeding tigresses, an area of 800-1,000 sq km be maintained as inviolate.

This, the ministry believes, would help maintain an overall population of 70-100 tigers maintainable in the patch along with surrounding buffer areas (where multiple land use is allowed with some regulation on industrial and other activities). Where such large areas cannot be declared inviolate, the attempt shall be to connect small CWHs with bigger ones by blocking connecting land corridors and declaring them inviolate as well. This will ensure the genetic viability and robustness of smaller tiger populations. Only in exceptional cases - where there is not sufficient land to declare as inviolate - shall such inviolate areas be maintained in isolation.

At present, there are 28 tiger reserves (with another eight proposed) and 604 national parks and sanctuaries covering about 24% of the forest areas and 4.74% of the total geographic area of the country.

For non-tiger bearing parks and sanctuaries, the ecological space required by other key species - top meat eaters, large-sized herbivores, economically important species, endangered species or migratory animals - will be used to measure how much space should be declared as inviolate.

The CWHs for tigers will be identified by a central committee comprising chief wildlife wardens of states concerned, the director and two scientists of the wildlife institute, field directors of existing tiger reserves, representative of the tribal affairs ministry, a wildlife scientist familiar with the area and the member secretary of the National Tiger Conservation Authority.

Source : Times of India, New Delhi, Novemberry29, 2007

माओ की मसखरी के किस्से

कम्युनिस्ट दर्शन को व्यवहारिक तौर पर सफल बनाने के करिश्मे की वजह से माओ को केवल चीन में नहीं, भारत समेत दूसरे देशों में भी सम्मान की दृष्टि से देखा जाता है। लेकिन माओ ने कई बार ऐसे अजीब फैसले लिए, जिन्हें अदूरदर्शिता और सनक ही मान सकते हैं। माओ को लोग पूंजीपतियों के दुश्मन के रूप में जानते हैं। उन्होंने ही स्टालिन को विश्वास दिलाया था कि वह पूंजीपति देशों के विनाश के लिए तीस करोड़ चीनियों को कुरबान करने से भी पीछे नहीं हटेंगे। लेकिन कितने लोग यह जानते हैं कि माओ चिड़ियों के भी कट्टर दुश्मन थे ? 1958 में जब उन्हें पता चला कि चिड़िया देश का चावल खा रही है, इसलिए चीनी भूखे हैं, तो उन्होंने हुक्म दे दिया 'मार चिड़िया'।

चीन के किसानों, पदाधिकारियों को कहा गया कि चिड़िया उड़ाओ, चिड़ियों के घोंसले और अंडे तोड़ो, गुलेल से मार दो। परिणामस्वरूप, चीन में लाखों चिड़ियों की जानें चली गईं। तो क्या चीन के चावल चिड़ियों से बच गए ? बाद में पता चला कि चिड़िया जितने चावल खाती थीं, उससे ज्यादा तो वे फसल बरबाद करने वाले कीड़ों को खा जाती थीं। चिड़ियां मरीं, तो कीड़ों की ऐश हो गई। चिड़िया रहित चीन में टिड्डियों की संख्या में अचानक बढ़ोतरी हुई और फसलें टिड्डियों के पेट में गईं और चीन में अकाल पड़ गया।

माओ की सनक चिड़िया मारकर ही खत्म हो जाती, तो भी गनीमत थी। उन्होंने तो देश के बाशिंदों को भी नहीं बख्शा। चीन में स्वाधीन खेती बंद करा दी और किसानों को झुंड में कम्युन खेती पर काम करने को मजबूर किया गया। यही नहीं किसानों से सस्ती दरों पर अनाज खरीदकर महंगी कीमत पर बेचा गया। किसानों को सिर्फ सरकार को ही अनाज बेचने की इजाजत थी। गांव वालों को मजबूर किया गया कि वे लोहा बनाने के लिए भट्ठी लगवाएं। उन्हें लोहा बनाने का टारगेट भी दिया गया। यानी माओ ने किसानों से बेगारी कराई। इसका असर यह हुआ कि खेत में अनाज पड़ा रह गया और 4.3 करोड़ लोग उस अकाल में मर गए। माओ की चंपू सरकार ने कितने ही लोगों को इस अत्याचार के बारे में खबर लीक करने के अपराध में मौत के घाट उतार दिया। अगर हिंदुस्तान में ऐसा होता, तो यहां सरकार गिर जाती।

वो जो चुप न रह सका ब्लॉग से अमर उजाला 15-5-2009

ग्रीनहाउस गैस मापने का कार्बन काउंटर

पर्यावरणवादी पिछले काफी समय से पृथ्वी का तापमान बढ़ाने वाली और जलवायु परिवर्तन को अंजाम देने वाली ग्रीनहाउस गैसों का उत्सर्जन कम करने के पक्ष में माहौल बना रहे हैं। हमारी जलवायु निरंतर परिवर्तित हो रही है। ग्रीनहाउस गैसों में कार्बन डाई ऑक्साइड, मीथेन, नाइट्रस ऑक्साइड, क्लोरोफ्लोरोकार्बन्स आदि शामिल हैं। लेकिन चूंकि कार्बन डाई ऑक्साइड इनमें प्रमुख है और पर्यावरण पर इसी का असर सबसे घातक होता है, इसलिए ग्रीनहाउस गैस में आम तौर पर इसी का उल्लेख होता है। जीवाश्म ईंधन का इस्तेमाल और जंगलों की कटाई ग्रीनहाउस गैस के प्रमुख स्रोत हैं। लेकिन ये गैसें चूंकि हमें दिखाई नहीं देतीं, इसलिए भी हम इनकी गंभीरता को आसानी से नजरअंदाज कर देते रहे हैं।

ऐसे में वैज्ञानिक और पर्यावरणवादी लंबे समय से ऐसी कोशिश में थे, जिससे कि लोगों को ग्रीनहाउस गैसों की मौजूदगी का पता चल सके। कार्बन काउंटर इसी दिशा में एक कदम है, जो मिनट-दर-मिनट ग्रीनहाउस गैस उत्सर्जन के बारे में बताता है। डेचसे एसेट मैनेजमेंट के मुखिया केविन पार्कर ने मैसाच्युसेट्स इंस्टीट्यूट ऑफ टेक्नोलॉजी ने विज्ञान और जलवायु परिवर्तन के साथ तालमेल कर बीते महीने न्यूयॉर्क में कार्बन काउंटर के सपने को साकार किया। जाहिर है, लोग ग्रीनहाउस गैस का मिनट-दर-मिनट उत्सर्जन का आंकड़ा देख इसके प्रति सचमुच गंभीर होंगे। कार्बन काउंटर ग्रीनहाउस गैस की सांद्रता को पीपीएम (पाटर्स पर मिलियन) से मापता है। इस समय यह 467 पीपीएम है। ग्रीनहाउस गैस उत्सर्जन की माप दरअसल 1959 में शुरू हुई। उस समय उत्सर्जन 310 पीपीएम था, जो वर्ष 2000 में बढ़कर 370 पीपीएम हो गया। पर्यावरणविदों के मुताबिक ग्रीनहाउस गैस का उत्सर्जन करीब 200 साल पहले तेजी से शुरू हुआ। यही वह समय था, जब दुनिया भर में औद्योगिकीकरण की प्रक्रिया ने रफतार पकड़ी थी। औद्योगिकीकरण से पहले ग्रीनहाउस गैस का उत्सर्जन 270 पीपीएम था। लेकिन उद्योग-धंधे के जड़ पकड़ने के बाद जीवाश्म ईंधन का इस्तेमाल बढ़ने लगा। पहले जलाने के लिए कोयले का इस्तेमाल हुआ, फिर तेल और बाद में गैस पर निर्भरता बढ़ी।

ग्रीनहाउस गैस का मामला इतना भीषण है कि तापमान में एक डिग्री सेंटीग्रेट की बढ़ोतरी से रॉयल बेंगॉल टाइगर (भारत) और माउंटेन गोरिल्ला (मध्य अफ्रीका) जैसी लुप्तप्राय प्रजातियां पूरी तरह से मिट सकती हैं। इसी तरह तापमान में एक से दो डिग्री सेंटीग्रेट की वृद्धि का मतलब होगा एशिया और दूसरी जगहों में धान की पैदावार का नष्ट हो जाना। इसमें कितनी भयावह खाद्य समस्या पैदा होगी, इसकी सिर्फ कल्पना की जा सकती है। जलवायु परिवर्तन पर अंतरसरकारी समिति का आकलन है कि तापमान और गरम होने से जहां समुद्र का जलस्तर ऊपर उठेगा, वहीं ग्रीनलैंड और पश्चिम अंटार्कटिक के हिमखंड पिघल जाएंगे। नतीजतन विश्व के कुछ इलाकों में घनघोर बारिश होगी, तो कहीं खूखा पड़ेगा। इससे दुनिया के अलग-अलग हिस्सों में बाढ़ और पानी की कमी दिखाई पड़ेगी। खेती में मुश्किलें आएंगी और व्यापक पैमाने पर खाद्य संकट का सामना करना पड़ेगा।

पर्यावरणवादी बताते हैं कि वर्ष 2050 तक ग्रीनहाउस गैस का उत्सर्जन कम करना ही होगा। इस समय इस गैस का उत्सर्जन हर महीने करीब दो अरब टन यानी 800 टन प्रति सेकंड है! यह आंकड़ा एकबारगी या तो अविश्वसनीय लगता है या फिर खतरनाक स्तर पर गंभीर।

सवाल यह है कि इस चुनौती का मुकाबला कैसे किया जाए? जाहिर है, चिंता जता देने भर से इस समस्या का समाधान नहीं होने वाला। कार्बन काउंटर भले ही न्यूयॉर्क में तैयार किया गया हो, लेकिन ग्रीनहाउस गैस के उत्सर्जन में कमी लाने के बारे में अमेरिका के रूख के बारे में किसी को शुबहा नहीं है। पूर्व अमेरिकी राष्ट्रपति बुश ने क्योटो प्रोटोकॉल के पालन के प्रति अपनी अनिच्छा ही जताई थी। यह भी साफ है कि ग्रीनहाउस गैस से पर्यावरण को गंदा करने में विकसित देशों का हाथ सबसे ज्यादा है। ऐसे में, पृथ्वी को और गरम होने से रोकने में वे आगे क्यों नहीं आते? अमेरिका और चीन जैसे देशों ने जैव ईंधन की जीवाश्म ईंधन के विकल्प के तौर पर ढूंढ तो लिया है, लेकिन इससे दुनिया भर में अनाज का संकट पैदा होने लगा है, क्योंकि जैव ईंधन मक्का आदि से बनाया जा रहा है।

पर्यावरणवादी सुझाते हैं कि वातावरण में कार्बन घोलने की कीमत वसूली जाए। यानी प्रदूषण के लिए दंड का प्रावधान हो। चूंकि अब तक लोगों और देशों को बेरोटोक जीवाश्म ईंधन का इस्तेमाल करने को मिला है, इसलिए भी वे लापरवाह हो गए हैं। बात सही है, लेकिन जो देश पर्यावरण को साफ करने के लिए अपना रवैया बदलने के लिए तैयार नहीं हैं, वे धरती को गरम करने की कीमत अदा करेंगे, यह मान लेना मुश्किल है। ऐसे देश अब जैव ईंधन की ओर मुड़ रहे हैं, तो इसके पीछे कोई अपराध बोध नहीं, बल्कि यह सच्चाई है कि आने वाले दिनों में कभी भी जीवाश्म ईंधन खत्म हो सकता है। इसके बावजूद उम्मीद करनी चाहिए कि पर्यावरण को बचाने के लिए सामूहिक कोशिशें शुरू होंगी। कार्बन काउंटर को इसकी शुरुआत मानना चाहिए।

अमर उजाला 5-7-2009

"Cheetal" Young Readers Section

Winning entries of the annual HT PACE inter-school essay writing competition which was held in association with the National Museum of Natural History (NMNH)

Encouragement prize winner

(JUNIOR Category)

Name-Nikhil Dubey, Class-IV A

School – RD Rajpal Public School

Topic-Earth is our mother once gone, we can't get another

A lady blessed with beauty and richness gave birth to a child called man. As the child grew, the mother did all what she could for the child's best. She gave everything that she had for the child's better life. But the child's demands were so big that she had to spend all she had. In the course of time she tried to explain to her child that he should spend the wealth wisely but in vain. Finally one day she lost all her wealth and was left ruined and exploited. Slowly she became sick and finally died. The son cried so hard but he could not get her back now. Doesn't this story resemble several lives? The lives of millions on this Earth. We all know that just a few hundred years ago, our Earth was full of greenery more fresh air, more fresh water throughout the year and rivers and was very rich in other resources. Life was healthy, the crops were in plenty without using artificial methods.

Few years back, a movie named *Water World* was screened. Though the film was based on fiction, it clearly showed us the future where everything would be under sea water due to the continuous rise in sea water level. The era when there would not be any land left, no fresh water to help the vegetation and all other living beings to survive on this planet. Over the years, we have been exploiting all the natural resources to fulfill our greed and requirements. Sometimes even to the extent of wasting these resources just for our comfort. We like using running taps or showers to take bath, we use fresh water to wash floors and vehicles. Aren't we exploiting Mother Earth?

We should not be amazed if our future generations ask questions like what is snow? How does it look like? What is a river? What is petrol? What is natural sweet water? Are we prepared to answer such questions? We all know that many of the rivers have vanished, and that we just know their names. Mother Earth is getting effected by global warming the forests, have been reduced by man, other resources like minerals and oils are being used up at a very fast pace to fulfill our need. We are generating so much heat and pollution in our daily life that it has badly affected not only our Mother Earth but also the atmosphere.

The solution lies with us. We should start using alternate source of energy such as solar energy, recycle things, harvest water and plant more trees. Mother Earth is already warning us of hard days to come. It's high time we start thinking about our mother and give her some care and

attention. Else we may end up like the son who exploited his mother for his survival and finally lost her.

Encouragement prize winter

(Senior Category)

Name- B Nalin

Class – M3-A

School – Gyan Bharati School, Saket

Topic – The Joy of life lies in nature's beauty and preserving it is our sacred duty.

Imagine: Ferrying on the Dal lake in a peaceful houseboat with flowerers all around you.

Imagine: skimming the mighty waves on a Goa beach, with the cool water splashing at you.

Imagine: Walking between the rows of flowers and fountains in the Brindavan Gardens of Mysore.

Imagine: Enjoying the sight of the tea-plantation in the valleys of Darjeeling.

Imagine: Seeing the silvery snowy mountains of Kashmir.

Imagine: Setting of the sun showing all the beautiful colours of nature at the Kovalam beach. The joy we get by being with the nature is really immense. Happiness, love, help, all come to us through nature and its beautiful gifts. We can only enjoy nature's gifts if we preserve them. In other words, preserving nature is enjoying nature. So don't we feel that preserving nature is our sacred duty? Preserving nature is depicting the duty of one and all, rather, it is the need of the hour, not harming nature. Harming nature includes deforestation, destroying the beauty of nature, pollution, harming animals and birds and last but not the least-wastage or exploitation of the gifts of nature. Harming nature leads to its gradual destruction. To reap the benefits of nature and to enjoy its beauty every citizen should make it his/her duty to preserve it from destruction.

Source : Hindustan Times, New Delhi, February 10, 2009

क्या किसी प्राणी के तीन हृदय भी होते हैं ?

कटलफिश (Cuttlefish) एक ऐसी विचित्र मछली है, जिसके तीन हृदय होते हैं, इसके दो हृदय गिलों (Gills) के पास होते हैं, जो अशुद्ध खून को गिलों में भेजते हैं, यह खून तीसरे हृदय में जाता है और वहां से शरीर के विभिन्न हिस्सों में पहुंचता है।

कटलफिश का रक्त भी विचित्र प्रकार का होता है, सभी जानवरों के रक्त का रंग हीमोग्लोबिन के कारण लाल रंग का होता है, लेकिन इस मछली के शरीर का रंग नीला होता है। इसके रक्त में हेमोसाइनिन (Haemocyanin) नामक पदार्थ होता है, जो रक्त को नीला बना देता है। हेमोग्लोबिन में लोहा होता है, जबकि हेमोसाइनिन में तांबा होता है। इस वर्ग की दूसरी मछलियों का रंग भी नीला होता है।

कटलफिश एक मुलायम मछली है, जो सेफलोपोडा (Cephalopoda) वर्ग में आती है। ओक्टोपस (Octopus) और स्क्विड (Squid) नाम की मछलियां भी इसी वर्ग में आती हैं। यह मछली लगभग सभी समुद्रों में पाई जाती है। अधिकतर कटलफिश समुद्री किनारों के उथले पानी में रहती है। इसका शरीर का रंग कथई होता है। शरीर पर कुछ धारियां और धब्बे होते हैं। सूरज की रोशनी में इसका रंग चमकदार दिखाई देता है। इसमें रंग बदलने की अपूर्व क्षमता होती है। इसकी लम्बाई 8 सेमी. से लेकर 1.8 मीटर तक होती है। इसकी अब तक सौ किस्मों का अध्ययन किया जा चुका है।

कटलफिश का शरीर एक प्रकार के थैले से घिरा हुआ होता है। इस थैले को मेंटल (Mantle) कहते हैं। सिर के एक सिरे से पतले-पतले टेंटाकल निकले होते हैं। इनमें से आठ टेंटाकल भुजाओं का काम करते हैं और दो स्पर्श करने का काम करते हैं। इन्हीं से यह शिकार पकड़ती है। मेंटल के दूसरी ओर फिन होते हैं। जो इसे तैरने में मदद देते हैं।

दुश्मनों से अपनी रक्षा करने का इसका बड़ा ही विचित्र तरीका है। जब इस पर कोई शत्रु हमला करता है, तो यह अपने थैले से स्याही जैसा काले रंग का पदार्थ शत्रु की ओर छोड़ती है। यह पदार्थ एक धुआं जैसे बादल के रूप में बाहर आता है। इस धुएं जैसे बादल में यह दुश्मन की आंखों से ओझल हो जाती है और अपनी रक्षा कर लेती है। इस पदार्थ से स्याही भी बनाई जाती है।

यह मछली वसंत ऋतु और गर्मियों में अण्डे देती है। एक मछली 100 से 300 तक अण्डे देती है। इसे खाने के काम में लाया जाता है। इसकी हड्डियां तोतों को खिलाने के काम आती है।

Family Life of Birds

It was 6.00 a.m on a Sunday morning in early spring and Arun was wide awake. Outside he could hear loud tweets, twitters, warbles, chirps, and cries. "Ever bird in the world seems to be singing its heart out in my garden and around!" Arun mumbled, pulling his window shut with a bang. Crawling back into bed, he wondered what in the world all those birds could be so happy about.

Arun didn't realize it but the birds outside his window weren't singing for joy. To a bird, singing is a serious matter - an important part of the breeding season. That's because singing is a bird's way of establishing its claim to a breeding territory, defending that territory, and, at least for some species, attracting a male.

The Season for singing

The male Magpie-Robin, Iora, Golden Oriole, Shama, Malabar Whistling Thrush, start singing from February onwards, to proclaim their breeding area and also to announce their presence to would-be spouses in the nearby area. The Koel and Common Hawk-Cuckoo start advertising their presence as the spring proceeds onwards. The Black Drongo's sweet song starts from June onwards. Greyheaded Flycatcher, Redbreasted Flycatcher, Large Cuckooshrike and a few other birds sing late in the year when they are setting up and defending winter territories. But singing is much more common and energetic from the beginning of spring to end of monsoon, as it is the main breeding season for many of the Indian birds.

Male songbirds usually do all of the singing, although the female Indian Robin, Iora and a few other females sometimes sing too. A bird's song means different things to different birds in the neighbourhood. to the males, it usually means "Keep off, this is my place!" But to females of the same species it may say "Here I am and I am looking for a mate!"

How do birds "become" singer? Through research, ornithologists (scientists who study birds) have discovered that some birds learn the characteristic songs of their species by hearing other birds sing it. But the songs of some other birds are completely innate. It means that a bird "knows" and can sing its species song without ever hearing it. For many birds, the song is somewhere in-between, being partially learned and partially innate.

Songs vs. Calls:

A bird's song is usually made up of several notes that the bird sings in a regular pattern, over and over again. Sometimes a singer will vary its song slightly, but the overall pattern of notes stays the same. e.g Singing Bush Lark. Not every note a bird utters is a part of its song, though. Birds also have calls. These are sounds they make during feeding, migration, or when danger is near. Unlike songs, calls are usually short-made up of one or a few short notes.

Thump, Strut and Drum: Not all birds are singers. But even some of the ones that aren't, make different kinds of noises to defend their territories or to attract mates. For example a male lesser Florican jumps perpendicularly upto two meters in the air emitting a croak-like sound, which is audible for a couple of kilometers away. It serves to attract females and repel rivals from its territory. In the same way a male Great Indian Bustard utters a deep booming call audible upto a kilometre or so and starts strutting from a slightly elevated place. Rufous, Indian Goldenbacked,

Threetoed, and Great Black Woodpeckers make drumming sounds by hammering tree trunks or bamboos. In Indian Button Quail and Little Bustard-Quails, the female, who has several husbands, establishes her territory and proclaims her presence by loud drumming calls. This warns rival females against trespassing her territory and attracts the males.

Displays that Dazzles: Singing, hammering, and thumping all help different kinds of birds find each other during the breeding season. but for many birds, sight is much more important than sound when it comes to finding a mate. Colour, special courtship feathers, and movements all play a big part in some birds courtship displays. Peacock, for example parade in front of the females, fanning and shaking their long colourful feathers.

Equally spectacular is the display of the Sarus Cranes. The male and the female run against each other from some distance, prancing, bowline with outspread wings, arcing and stretching their necks, fluffing body feathers and calling. This duetting goes on for quite some time. This is also called the 'Unison' call of the cranes.

The male Indian Robin flaunts his white shoulder patches against the black of his body with wings drooping at the sides. He stretches his neck skyward and at the same time cocks up his tail and bends it on his back. This helps in displaying the chestnut colour around the vent. The display of the male Indian Robin, though not dazzling, is certainly an attractive sight. The male Iora highlights his black, yellow and white colours by fluffing the feathers during his display. Mass display is not uncommon in different crane species. Great Pied Hornbills, huge arboreal birds of evergreen and moist deciduous forests in the Western Ghats and the Himalayas, have also been observed in a sort of a mass display.

All Kinds of Nests

Once a bird has found a mate, nest building begins. In most of the birds, the male and the female work together in nest-building. All common birds like sparrows, crows, pigeons, doves, mynas, bulbuls and many more come under this category. In some instances only the female bears the responsibility of nest-building e.g. Fairy Bluebird, Black bellied Finch-Lark, rosy Minivet, Common Peafow, and Lesser Florican. And in some exceptional birds nest-building is carried out by the male e.g. Painted Snipe, Bronzewinged Jacana as well as the Button Quail and Little Bustard-Quail.

When most of us think of a bird's nest, we think of typical grass, twin and mud "cup" that many birds build. But birds' nests come in a lot of different shapes and sizes including some very unusual ones.

Keeping the Eggs Warm: All birds lay eggs and most birds incubate their eggs, or keep them warm, with the heat of their own bodies.

A few birds bury their eggs in dark sand, in warm soil next to hot springs or in fermenting vegetation, all of which produce enough heat to hatch the eggs. In India there are no birds of this type. But Megapode, a huge bird found in the Nicobar islands, lays its eggs in huge nest mounds made by scraping sand, leaves and vegetable matter. The eggs hatch by the heat of the sun and of

decaying vegetable matter.

In several bird species, the male and the female take turns keeping the clutch, (group of eggs in the nest), warm. And there are a few species in which both parents sit on the clutch at the same time. But when one parent is more colourful than the other, the drabber, harder to see parent usually does most of the incubating. In polyandrous birds (where female has more than one mate), the incubation is carried out solely by the male e.g. the Painted Snipe, the Bronzewinged Jacana, Button Quail and Little Bustard-Quails.

Hatching out: After as few as 11 days, or as many as 90 days, depending on the species, a young bird is ready to hatch out of its egg. Using the sharp "egg-tooth" on the top of its beak the young bird slowly chips away at its eggshell, usually without any help from its parents. Several hours (or sometimes even several days) later, it breaks free of the egg. Some newly hatched birds are blind, naked, (i.e without any feathers), and unable to care for themselves. These helpless or altricial birds as they are called lay in the nest until they fledge, or take their first flights. They are fed by their parents, who make trip after trip to the nest with insects and other high protein food. Even after they fledge, many altricial birds continue to be fed by their parents for a while.

Many ground nesting birds are precocial. Unlike altricial birds, precocial chicks can see well and are covered with down feathers when they hatch. In almost no time at all they can run around and even find their own food.

Some birds aren't completely altricial or precocial, but are some where in between e.g. Blackbellied Tern.

Insects

Staying Alive

Insects are very successful group of animals and are the most abundant on earth as 75 percent of all animals are insects. They have been around here long before the dinosaurs roamed the earth. Insects seem to have appeared around 350 million years ago, when there happened a great insect 'boom' in the lush gloomy fern forests of the world. Though much of the evolutionary history of these insects is left to guess work, the very few fossil records that have been found show that the structure of the bristle tails and cockroaches of around 30 million years ago was probably very similar to those existing now.

Today, insects have managed to survive in almost every type of habitat.

One of the reasons for their success is their ability to reproduce quickly. Like all living things, insects have the ability to adapt to a changing environment. (Adaptations do not occur overnight or in some years but over several generations).

Because they multiply faster insects can adapt more quickly to new situations than many other types of animals.

The ability to reproduce quickly is just one of the ways insects have adapted. Here are other adaptations that have contributed to the success of insects.

Small size: Because of their small size, insects can live in places that many other animals can't. This gives them an advantage in finding a place to live and in hiding from predators. Just imagine how the bedbug lives in the tiny cracks in bed or bench and when you go to quash it, it disappears among the crack where you are unable to reach it.

Hard Exoskeleton: Having a hard outer covering (exoskeleton) is a great protection. This means that insects wear their skeletons outside their bodies: that protects them from predators, and from drying up.

Eggs for the future: Insects have large numbers of offspring and a high reproductive rate. For example, some fruit flies (*Drosophila*) have 25 generations in one year. (Compare that to humans, who have one generation every 25 years). Each female can lay up to 100 eggs. Now suppose a female laid 100 eggs and all those eggs hatched into adults (50 males and 50 females). And suppose all those flies mated and each female among them laid 100 eggs and all those eggs hatched, survived, grew and the females laid 100 eggs each. Now if these ideal conditions prevail for 2 generations, then by the end of the year, if all the offspring lived and reproduced, can you calculate how many flies there would be? You can be sure it would be a lot of flies. And imagine, all these from just one original female fruit fly!

Of course, all insects don't survive. Most are eaten by other insects, frogs, lizards, birds and insect-eating mammals like shrew or hedgehogs. Those insects around farms and houses are often poisoned by insecticides. Others are infected by diseases or parasites or killed in some way before they get a chance to mate and lay eggs.

But having large numbers of offspring is important. Most insects, like other invertebrates, do not care for their young after they hatch. The females lay hundreds of eggs and leave them to

survive on their own. These large numbers ensure that at least some of the young will survive. Yes, some insect females, like the earwig, do take care of their eggs and brood. Mammals and birds have a different reproductive strategy to ensure survival of their young ones. They have very few young. But each one has a much greater chance of surviving because it is cared for by the parents and may learn the art of survival from its parents.

Some butterflies like Common Mormon or Lime butterfly will always lay eggs one or two at a time per growing shoot of the food plant. Thus over-crowding is avoided and their caterpillars have enough to eat. Even those moths like Tusker moth and other insects who lay their eggs in clusters will lay in small groups at different places. That means they too are aware of the need to not keep all the eggs in the same basket.

Parthenogenesis or virgin birth is known to occur in some insects, where even the unfertilized eggs develop and offspring are born. This occurs in aphids, scale insects, moths, flies, beetles, ants, bees and wasps. Usually in these cases the entire brood of the offspring will be of all males or all females.

Coming back to the number of eggs the queen termite is unbeatable. During her long lifespan she lays as many as 500 million eggs.

Camouflage: One of the best ways to keep from being eaten is to keep from being seen. Hiding and disguising are forms of camouflage. The Oleander Moth has a pattern on its wings that makes it invisible among the leaves. A similar pattern is used in the army for the jungle combat uniforms and the vehicles. Stick insects, with their grass-like body structure and colour, are almost impossible to trace. Green leaf-like Katydid grasshoppers and several such insects are masters of camouflage.

A Strong Defense: Almost no one has escaped ant bites. Ants resort to biting for self defence; and everybody dreads the nasty sting of bees and wasps which is their defence against predators. Some insects will defend themselves from predators with special protective adaptations such as chemical sprays. The two-spotted bombardier beetle repels its tormentors with a hot spray and the stink bug will give off an obnoxious smell to ward off predators.

The Blister beetle gives off canthardin to cause blisters to those who dare to peck at it, and hairy caterpillars of moths can give a bad itching rash. A brush with a nettle or slug caterpillar is an extremely painful experience.

Several of these insects which harbour poison or other defence mechanisms have bright warning colors which the predators soon learn to associate with their unpleasant experience.

Mimicry: Many insects look like something they are not. This is called mimicry. Some use mimicry, to escape from being noticed such as Looper caterpillars which can be easily mistaken for dry twig of the plant.

The Oakleaf butterfly is a classic example of mimicry. It has on the undersides of its wings the exact colour pattern of a dead leaf, complete with 'stalk', 'midrib' and even 'fungus' and 'wormholes'. When disturbed it opens its wings to take off, flashing a brilliant blue that momentarily startles the predator and gives the butterfly an opportunity to fly away and 'disappear among the

dead leaves, leaving the predator to search for a blue butterfly. Most pupae of butterflies, being stuck at one place, are well camouflaged to look like a leaf or a broken dry twig and Common Lime butterfly's pupa is a perfect example. Some insects like the tree hoppers mimic thorns on a bush.

Sometimes harmless insects mimic poisonous or stinging insects. For example the day flying Bee Hawk moth mimics wasps and bees. If a bird has tried to eat a wasp or bee and has been stung, it will remember its painful experience and will avoid anything that looks like a bee or a wasp, even if it is the harmless Bee Hawkmoth.

Surprise: Some insects surprise their predator with unexpected 'tricks'. For example several of the hawk moth caterpillars have huge eyespots near their heads and when alarmed, they puff up, displaying their eye-spots and sway like a snake. The owl moth has two huge eye-spots on its dark body and while the owl moth rests in the daytime under overhanging rocks, an approaching predator (usually a bird), mistakes those two eyes to be those of an owl or a cat, of whom the birds are scared. The Eyed Praying Mantis, when cornered, will spread all its four wings displaying the eye-spots so as they appear larger and dangerous to the predator.

The Silverline butterfly has eye-spots and tails on the hind wings. When alarmed the butterfly rubs its hind wings to move its tails thus giving an impression that the head is at the rear end, and the attack is deflected towards the false head instead of some vital part. Losing bits of wing edges does not adversely affect the butterfly.

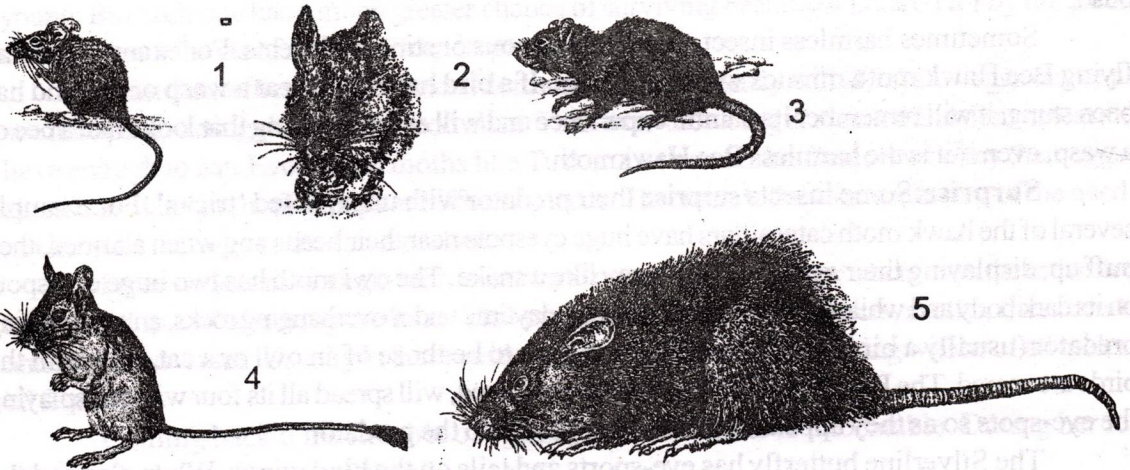
Freeze: Many insects, such as weevils, click-beetles, dung beetles, some butterflies and moths freeze or play dead when predators try to attack. Often caterpillars and beetles will drop down from their perch to remain without moving among the fallen leaves. Many a times it is the prey's movement that triggers attack response in a predator.

Escape: And when nothing works, then most insects fly away. Cockroaches and silverfish are good at escaping since their legs are specially suited for running to make a fast getaway from predators.

Do a common Thing in a uncommon way
Booker T. Washington

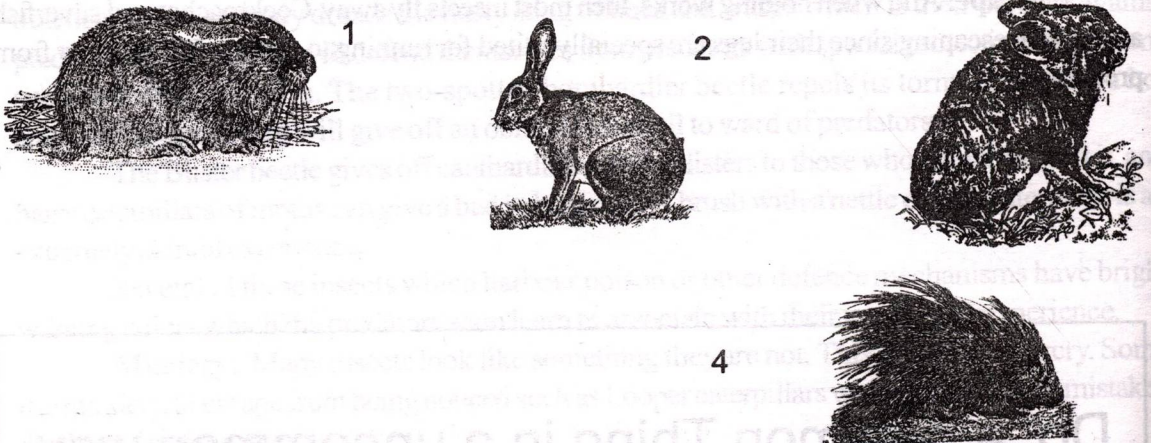
Wildlife Photo Series for Identification

Rats & Mouses



1. The Indian Field Mouse *Mus booduga*
2. The Longtailed Tree Mouse *Vandeleuria oleraces*
3. The Indian Mole-Rat *Bandicota bengalensis* Local Name Beng. Tekrat; Kan. kok, heggana; Tel. golatta koku; Mar. ghus.
4. The Indian Gerbille *Tatera indica*
5. The Bandicoot Rat *Bandicota indica*

Hares & Porcupine



1. Hispid Hare *Caprolagus hispidus*
2. Blacknaped Hare *Lepus nigricollis nigrocollis* Local Names. Hindi Khargosh; Mar. sasa; Kan mola; Tamil musal; Tel choura pillt; Mal. motlu.
3. The Himalayan Mouse-Hare *Ochotona roylei* Local Names. Botia gumchi picht; Lepcha cumchen.
4. The Indian Porcupine *Hystrix indica* Local Name Hindi sayal; sahi; Mar sheval, salendra, saloo; Kan. yed, moolu handi; Tel. yedu pandi; Mal& Tamil moollam punnt; Bur. hreeu.



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Signature

The Wildlife Preservation Society of India

1. The aims and objects of the Society are as follows :-

- (a) To promote interest and impart knowledge regarding the preservation and conservation of all forms of wildlife, particularly among the youth of the country.
- (b) To cooperate with the Govt. of India and State Governments and with others Societies and Institutions having similar aims and objects in working for the interests of wildlife.
- (c) To assist in enforcing and actively supporting the Forests Acts. Wild Birds and animals Protections Acts and Rules etc. of State Governments and the Indian Arms Act and Rules in so far as they pertain to wildlife and to bring to the notice of the authorities any infringement of the same and to assist in the detention and prosecution of offenders in respect of such laws.
- (d) To advise and help the Govt. and wildlife administrators in the formation, maintenance and protection of Sanctuaries and National Parks, preservation of wildlife in general and endangered species of India in particular and in the introduction of exotic species into the country, rehabilitation of endangered species etc. and in the formulation and amendments of rules and acts, so as to conserve and increase wildlife stocks.
- (e) To raise funds for carrying out the above aims and objects and to found and maintain museums reading rooms and libraries of natural history in order to disseminate knowledge regarding wildlife.
- (f) To carry out publicity and propaganda for the preservation of wildlife in India by means of monographs, journals, films, filmstrips and other feasible methods.
- (g) To assist members of the Society in obtaining facilities for viewing and photographing wildlife in India.
- (h) To conduct research into the problem of Wildlife management in India, and in pursuance of this, to initiate, encourage and, where possible assist in the projects of the study of threatened species and related objects and to provide reference and research facilities for such work.
- (i) To carry on such other activities which will serve the above subjects.

2. What membership of Wildlife Preservation Society of India will entitle you to ?

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- (7) You will be supplied "Cheetal", the quarterly journal of the society free.

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